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FISHER (R. C.). **Building Reconstruction and the Death-watch Beetle.**—*J. chart. Surv. Instn* **20** p. 645 repr. 8 pp., 6 refs. London, 1941.

Recent work on the biology of the death-watch beetle, *Xestobium rufovillosum*, DeG., in structural timbers in buildings in Great Britain is reviewed [*cf. R.A.E.*, A **23** 156; **25** 494; **26** 34, 380; **29** 178, 315], and attention is drawn to the desirability in restoring or re-erecting buildings damaged by air attack of preventing eventual infestation by using oak timber that is adequately seasoned and free from all traces of decay, and by excluding sapwood, which is particularly liable to attack by fungi, unless it has been treated with a preservative. Oak heartwood is one of the most durable timbers and need not be treated with preservatives if structural precautions are taken. Softwoods (coniferous timbers) are not normally attacked by *X. rufovillosum*, but if they are in contact with infested oak, or in its immediate vicinity, they may be severely damaged. They are much less resistant than oak to decay, and if they are used in conjunction with oak and other hardwoods, they should be given a surface coating with a good preservative. Wherever possible, free circulation of the air should be allowed at the ends and along the faces of built-in timbers [*cf.* **28** 452], strict precautions being taken to avoid the access of moisture. Oak timbers that have been dislodged or damaged should not be re-erected unless they are free from attack by *X. rufovillosum* and have been sterilised by heat or treated with an effective insecticide. It is suggested that timbers that are to be re-used should be singled out and stored under suitable conditions until such time as they are required.

Simple measures to be taken in infested buildings, such as churches, where thorough treatment is not at present practicable, include the collection of living beetles, particularly in April and May, when they emerge from infested wood, spraying the timbers in spring to destroy the eggs and young larvae, and ensuring that the timbers are kept dry.

Insect Attack consequent on war-time Fellings.—3 pp. London, For. Comm., 1940.

Notes are given on measures that are essential for the prevention of increased injury by *Myelophilus piniperda*, L., and *Hylobius abietis*, L., to young plantations of pine in Great Britain as a result of war-time felling [*cf. R.A.E.*, A **29** 323, 383 etc.]. They include systematic trapping of *H. abietis* in early summer with bark or billets of pine. Slabs of fresh pine bark about 12 ins. square should be laid on the ground, inner side down, and lightly covered with sods. The traps should be set out 22 yards apart in rows 44 yards apart at the beginning of March and visited at least every other day for the destruction of weevils. Unless they are renewed every month, a little fresh sawdust should be placed under the bark every few weeks. When the weevils become numerous, the number of traps should be increased to about 25 per acre. Billets of pine, about 2 ft. long and 2 ins. in diameter, should be partly buried almost horizontally and covered with soil and turf for about two-thirds of their length. The weevils collect on the under side of the billets.

The weevils of the second brood, which emerge in August and September, are caught most readily by traps consisting of small heaps of fine branches bearing clusters of needles, which should replace the

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billet or bark traps at the end of June. Delaying replanting for a few years greatly reduces the risk of damage, as pine stumps become unattractive as breeding places two or three years after felling, and this method of protection is recommended for infertile sites, but is inadvisable on better soils where weed growth is strong and adds to the difficulty of establishing a plantation.

HUTSON (J. C.). **Report on the Work of the Entomological Division.**—*Adm. Rep. Dir. Agric. Ceylon 1939* pp. D19–D20. Colombo, 1941.

Insect pests that occurred in Ceylon in 1939 included *Nilaparvata lugens*, Stål (*greeni*, Dist.), *Chilo dichromellus*, Wlk., and *Haltica cyanea*, Weber, on rice; *C. simplex*, Btlr., and *Sesamia vuteria*, Stoll, on adlay [*Coix lachryma-jobi*]; *Dacus ferrugineus*, F., on avocado pear, sour-sop [*Annona muricata*] and banana; and the jak fruit-borer [*Margaronia caesalis*, Wlk.] on breadfruit [*Artocarpus communis*]. Severe fall of *Citrus* fruit was caused in several localities by fruit-piercing moths, mainly *Othreis fullonia*, Cl. (*fullonica*, L.), *Eumaenas* (*O.*) *salaminia*, Cram., and *Phyllodes consobrina*, Westw. The leaf-hoppers of the genus *Idiocerus* were unusually prevalent on mango blossoms, which were also damaged by the larvae of *Selepa* (*Plotheia*) *celtis*, Moore. Soy beans were attacked by the leaf-mining larvae of *Aristotelia* sp. (which were controlled by a spray of nicotine sulphate and soap), ground crickets (*Gymnogryllus*), several species of leaf-eating caterpillars and *Araecerus fasciculatus*, DeG.

Small local outbreaks of *Nephantis serinopa*, Meyr., occurred on coconut in Batticaloa. The pupal parasite, *Trichospilus* [*pupivora*, Ferrière], was liberated in all infested areas and appeared to have become established in most of them by May. Breeding of the imported parasite [*Prorops nasuta*, Wtstn.] of the coffee berry borer, *Stephanoderes hampei*, Ferr. [*cf. R.A.E.*, A **28** 563] was unsuccessful, and no further liberations could be made. Experiments with baits containing citronella oil showed that there is a minor season of prevalence of *Dacus* spp. during February and March and a major season during June–August at Peradeniya; breeding of the introduced parasites, *Dirhinus* [*auratus*, Ashm.] and *Spalangia* sp., was continued, and large numbers were liberated. The results of harvesting the crops of the second and third generations of lac [*Laccifer lacca*, Kerr] in two districts indicated that only two satisfactory crops can be produced in any given locality, owing to serious damage by predators [*cf. loc. cit.*].

HAWLEY (I. M.) & DOBBINS (T. N.). **Mortality among hibernating Larvae of the Japanese Beetle with special Reference to Conditions in the Winter of 1935–36.**—*J. N. Y. ent. Soc.* **49** no. 1 pp. 47–56, 1 map, 4 refs. New York, N.Y., 1941.

Since 1916, when a few examples were found in New Jersey, *Popillia japonica*, Newm., has moved outwards in all directions, and isolated colonies, apart from the area of general distribution, now occur as far north as Brewer, in Maine, and as far south as Atlanta, in Georgia. The climate at some of the isolated sites to the north has brought about marked changes in the life-cycle of the beetle, but it has been established in them for several years, indicating that any limiting influence of climate has not, as yet, become operative.

The winter of 1933–34 was unusually severe throughout most of the eastern United States, but the mortality among overwintering larvae of *P. japonica* was not appreciably higher than in milder winters [*R.A.E.*, A **23** 320]. In 1936, however, a heavy mortality was associated with a cold period that occurred in January and February, and involved unusual meteorological conditions, although soil temperatures at Moorestown were not so low as in 1934. Comparison of meteorological data for the cold spells in 1934 and 1936 indicates that the mortality was occasioned by a complex of factors, probably involving moisture as well as low temperature. The areas in which heavy mortalities occurred were largely those associated with a heavy coating of sleet or glaze, and such coatings, by restricting ventilation, may have helped to kill the larvae. High pressure exerted by water freezing in the soil may also have influenced mortality.

McKenna (G. F.) & Hartzell (A.). **Effect of wetting Agents in increasing the Efficiency of Sprays used in Control of Japanese Beetle.**—*Contr. Boyce Thompson Inst.* **11** no. 6 pp. 465–471, 1 fig., 5 refs. Menasha, Wis., 1941.

In the course of experiments with 19 liquid and 15 powdered proprietary wetting agents to improve the efficiency of lead-arsenate sprays commonly used against adults of *Popillia japonica*, Newm., in the United States and to reduce the unsightly residue, three liquids and one powder proved soluble or emulsifiable in water, compatible with lead arsenate and nicotine sulphate and non-toxic to sensitive plants such as tomato and buckwheat, and the liquids dissolved pyrethrum resin. Two of these liquids were Ultroil, a sulphonated vegetable oil with a pH of 6·5, a flash point of 475°F., and a boiling point of 100°C., and Daintex, a mixture of miscible terpene alcohols and hydrocarbons. Field tests in 1939, in which they were used in sprays containing pyrethrum resin and either lead arsenate or rotenone dust, showed that Ultroil was rather more effective than Daintex, and that lead arsenate gave better control of the beetles and retained its effectiveness longer than rotenone. None of the sprays left an unsightly residue on the foliage. In field tests in 1940, sprays of 4 lb. lead arsenate per 100 U.S. gals. water were equally effective against *P. japonica* on roses with the addition of either 0·5 per cent. Ultroil or 4 lb. wheat flour per 100 U.S. gals., and more effective than sprays of tetramethyl thiuram disulphide (Du Pont's repellent), and little feeding occurred on plants, including rose, elm and willow, sprayed twice with lead arsenate and Ultroil, though untreated plants were severely injured.

The dioctyl ester of sodium sulphosuccinate (Aerosol OT), the best of the powdered substances tested, wetted young holly plants (*Ilex opaca*) satisfactorily in the laboratory at a dilution of 1 : 1,000 in a spray of fish oil, lead arsenate and water, but is probably too expensive for practical use. The spray injured buckwheat plants slightly, but they recovered within 48 hours.

Fleming (W. E.), Burgess (E. D.) & Maines (W. W.). **The Use of Traps against the Japanese Beetle.**—*Circ. U. S. Dep. Agric.* no. 594, 11 pp., 3 figs., 4 refs. Washington, D.C., 1940.

This circular is a revision of an earlier publication [*R.A.E.*, A **22** 633] on the use of traps for the control of the Japanese beetle [*Popillia japonica*, Newm.] in the United States, with notes on recent improvements in the design of the traps. The construction of the various parts is described, and specifications for the geraniol and eugenol used in baits and instructions on the methods of operation and maintenance of the traps are given. Recent work has shown that they are most efficient when painted a shiny yellow [*cf.* **29** 126].

Entomology and Economic Zoology.—*Rep. Arizona agric. Exp. Sta.* **49** (1937–38) pp. 45–46. Tucson, Ariz., 1939. [Recd. 1941.]

Investigations on the Cecidomyiid, *Itonida citrulli*, Felt, on watermelon [*Citrullus vulgaris*] in Arizona [*cf. R.A.E.*, A **23** 381] showed that the first adults appear in early July and that cultural methods, such as early planting and crop rotation, are the only practicable control measures.

Fifty-third Annual Report 1939–40. Colorado Experiment Station.—62 pp. Fort Collins, Colo., 1940.

One section of this report (pp. 23–26) deals with work on insect pests in Colorado during the year ending 30th June 1940. Grasshoppers were the greatest general problem. *Ptinus fur.*, L., was again recorded in the State [*cf. R.A.E.*, A **28** 489]. In experiments, some strains of potato showed resistance to Psyllid yellows, caused by the feeding of the Psyllid [*Paratrioza cockerelli*, Šulc]. The Pentatomid, *Chlorochroa sayi*, Stål, attacked potato severely in some localities ; as many as 27 bugs were observed on single plants, and their feeding produced a condition very similar to Psyllid yellows [*cf.* **28** 147], for which the name " big bug blight " is suggested. In tests of pyrethrum dusts made of Dry Pyrocide [*cf.* **25** 553] against the squash bug [*Anasa tristis*, DeG.] the most effective, as measured by yield, was a 1 : 9 mixture with talc.

ALLEN (N.) & HARRISON (P. K.). **The Turnip Aphid in the southern States and Methods for its Control.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1863, 9 pp., 8 figs. Washington, D.C., 1941.

Rhopalosiphum pseudobrassicae, Davis, is one of the most destructive and widely distributed pests of turnip, mustard, radish and related crops in the United States and causes heavy losses every year, especially in the southern States. Reproduction is exclusively viviparous, 50–100 young are produced on the undersurface of the turnip leaves over a period of 20–30 days, and there may be 15–46 generations in the year in the Gulf coast region. The Aphids mature in 10–12 days and may live for two months under favourable weather conditions. In Louisiana and other States bordering the Gulf of Mexico and south Atlantic, they are active throughout the year, but most numerous and injurious between late autumn and early spring, at the best time for growing their favourite food-plants. The summer is spent by wingless forms on wild and scattered cultivated food-plants ; winged forms develop in early autumn and migrate to seedlings, on which they immediately reproduce. Both forms are present until late spring, when a greater proportion of winged Aphids develop and migrate to the summer food-plants.

Dusts of derris or cubé (1 per cent. rotenone) or of nicotine sulphate and hydrated lime (3 per cent. nicotine) are recommended for control [*cf. R.A.E.*, A **27** 371], and good results have been obtained with a spray containing 2 lb. finely ground derris or cubé root (4–5 per cent. rotenone) per 50 U.S. gals. water, applied when the plants are dry, preferably late in the afternoon, at the rate of 100–125 U.S. gals. per acre, at intervals of 7–14 days. For successful production of crops exposed to attack, the plants should be kept in a state of rapid growth; planting in drills facilitates the application of insecticides, permits cultivation, conserves the soil moisture, stimulates plant growth and hastens maturity. A nitrogenous fertiliser should be applied at the rate of 100–200 lb. per acre soon after the plants appear, the crops should be harvested completely as soon as they are ready for market, and all refuse should be fed to livestock or ploughed under immediately.

ENGLISH (L. L.) & TURNIPSEED (G. F.). **Control of the major Pests of the Satsuma Orange in South Alabama.**—*Bull. Alabama agric. Exp. Sta.* no. 248, 48 pp., 17 figs., 33 refs. Auburn, Ala., 1940.

The following is based on the authors' introduction and summary. The satsuma orange, which has been grown for a number of years along the Gulf coast in Alabama and neighbouring States, is attacked by most of the pests that attack oranges in Florida, and damage by *Lepidosaphes beckii*, Newm., *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm., *Dialeurodes citri*, Ril. & How., and *Paratetranychus citri*, McG., is so severe that annual control measures are necessary. Experiments on the bionomics and control of these pests [*cf.* *R.A.E.*, A **26** 690] have been carried out at Spring Hill Field Station since 1928, and the results are given in this bulletin. Because of the inter-relation of insect and disease control and the importance of sour scab (caused by *Sphaceloma fawcetti*), experimental data on the control of scab are included.

L. beckii is the most serious pest of satsuma oranges along the Gulf coast and, if uncontrolled, may render 75–80 per cent. of the fruit unmarketable, while the trees are weakened or killed. Its development is almost continuous, but is retarded by cold weather, the shortest life-cycles and greatest hatch of eggs occurring in summer. Spring sprays of Bordeaux mixture containing oil or sulphur aid in controlling the scale, but the best results are achieved by a single oil spray in July. Frequent use of sulphur sprays gives only partial control. *Phyllocoptruta oleivorus* may russet young fruits in early summer, but causes more serious damage in late summer or early autumn. If control measures are neglected, 50–70 per cent. of the fruit may be russeted. Sulphur sprays and dusts, preferably the latter, applied in August give good control, but occasionally it may be necessary to dust in May or June. *D. citri* causes damage by sucking the plant juices from the leaves and by the egestion of honey-dew, which favours the growth of a sooty mould. Infested trees are much more susceptible to low temperatures than uninfested ones. This Aleurodid is present only in the larval stage during the winter, adults starting to emerge at the end of March and beginning of April. Sprays of Bordeaux-oil should be applied just before the adults emerge. *Paratetranychus citri* is a major pest of satsuma oranges, with a peak period usually between March and May, but it does not thrive in hot weather, and from July to September infestations are light. Oil sprays are effective and, if applied in July, will keep trees relatively free from mites for several months. When this spray is used annually, control is easily maintained. Sulphur dusts and sprays are not effective.

Highly refined white oils are much more desirable for use on satsumas than unrefined oils, especially when the trees are subjected to critical climatic conditions. Spray programmes including applications of oil in July and September seriously delay maturity and reduce the yield of satsumas after the first year. However, a refined white oil with a viscosity of 78–80 seconds (Saybolt) was applied at a concentration of 1·5 per cent. in July for four successive years without material effect on the maturity or yield of the fruit. Although liquid lime-sulphur was conducive to early maturity of the fruit, the occasional severe injury caused by this spray makes its use unwise. Sulphur applications should be confined to dust and wettable sulphur. Spray schedules for effective and economical control of sour scab and the Arthropod pests of satsumas are given.

[Bissell (T. L.).] **Entomology.**—*Rep. Ga Exp. Sta.* **52** (1939–40) pp. 58–64, 1 fig. Experiment, Ga. [1940.]

Work on insect pests in Georgia during 1939 included observations on the dates of emergence from hibernation of adults of the cowpea curculio [*Chalcodermus aeneus*, Boh.], estimated, as in 1938, by collecting them on cowpea plants near fields in which this crop was grown during the preceding year. In 1939, emergence began on 21st April, five days earlier than in 1938, and the largest collections were made in the third week of July. Of weevils caged on plants without pods to prevent reproduction, 17, 49 and 86 per cent. were dead by 1st July, 1st August and 1st September, respectively, in 1938, and 17, 27 and 48 per cent. on the same dates in 1939, when they were potentially capable of greater damage to late planted cowpeas. Observations on cowpeas planted in early May and early July showed that infestation is greatly reduced by late planting if there are no early cowpeas in the neighbourhood to provide pods in which an early generation can be produced. Infestation was also found to be much less severe in the extreme north of the State. Constant varietal differences in susceptibility to infestation were observed during four seasons, and observations in 1938 and 1939 showed that infestation was less in varieties with small seeds and those with tough seeds and pods, but was not correlated with the colour or sugar content of the seeds. An autumn ploughing experiment showed that the weevils migrate from ploughed to unploughed land. In November, two months after ploughing, they were 14 times as numerous in the unploughed areas, and the possibility of control by leaving an unploughed strip with standing plants in which the weevils can congregate and which are subsequently burned is suggested. In April 1940, very few weevils were found in any part of the field except on the terraces, which were in heavy Bermuda grass [*Cynodon dactylon*] and where none was found in November. Some evidence was obtained that weevils are killed by disturbance of the soil.

Infestation of tomato by the tomato fruitworm [*Heliothis armigera*, Hb.] was reduced in 1939 by dusts of calcium arsenate and lime or cryolite and talc, baits of calcium arsenate or cryolite in maize meal, and a spray of cryolite with an adhesive. Four applications of all materials were made, and infestation on treated plants varied from 1·3 to 3·8 per cent., the differences between treatments being insignificant. An Ichneumonid, *Sagaritis provancheri*, D. T., parasitised larvae in tomato fruit and on vetch, but nothing is known regarding its effectiveness.

The southern corn rootworm [*Diabrotica duodecimpunctata*, F.] is injurious to maize, especially when it follows winter cover crops, throughout the State. The overwintered adults become active about the end of March, and eggs are deposited on the soil beside leguminous plants or grasses. In experiments on the effect of various combinations of different dates of ploughing (13th March–1st May) and sowing (5th April–15th May) on the degree of infestation of maize following winter peas, all maize sown on 15th May was uninjured, regardless of the date of ploughing, but the yield was slightly lower than that from maize sown on 1st May. Infestation was greatest in plots ploughed on 1st April and sown on 1st May, and the highest yields were obtained from plots ploughed and sown on 1st May. Injury was first observed on 24th April and continued until June; larvae were most numerous about 21st May. The most severe injury developed on soil ploughed on 13th March and 1st April, and it was evident that, in contrast to experience in Alabama [*R.A.E.*, A **18** 620], eggs were laid in the interval between ploughing and sowing.

The leaves of water oaks and willow oaks in north central Georgia were conspicuously blanched in June 1939 by a mite of the genus *Paratetranychus*, possibly *P. ununguis*, Jac., but it had apparently ceased to feed by 1st July, and many trees made new growth. Winter eggs were deposited on the wood, but development in 1940 was retarded by cold weather in spring, and there was no apparent damage by 24th May. *Anticarsia gemmatalis*, Hb., was very injurious during the autumn of 1939, when it defoliated cowpeas, kudzu [*Pueraria hirsuta* (*thunbergiana*)], ground nuts [*Arachis hypogaea*], soy beans and velvet beans [*Stizolobium*]. The corn ear worm [*H. armigera*], the alfalfa caterpillar [*Colias eurytheme*, Boisd.] and other Lepidopterous larvae occurred on ground-nut in smaller numbers, and the Noctuid, *Mocis* (*Pelamia*) *latipes*, Gn., attacked soy beans in September.

EDDY (C. O.). **Entomological Progress. Number 2.**—*Bull. La agric. Exp. Sta.* no. 323, 51 pp., 7 figs., 18 refs. Baton Rouge, La., 1940.

This bulletin comprises a collection of brief reports by various authors on insect pests and their control in Louisiana.

C. O. Eddy summarises the results obtained in experiments with cryolite. It can be safely used against chewing insects on sugar-cane, soy beans, cucumber, garden beans, velvet beans [*Stizolobium*] and many other garden and field crops that are injured by lead or calcium arsenate or even by the improved and stabilised calcium arsenate [*cf. R.A.E.*, A **27** 372], and has caused only insignificant injury to maize. It gave very little control of the boll weevil [*Anthonomus grandis*, Boh.] on cotton, but, unlike calcium arsenate, caused no injury to growing rice in the year following application to cotton. It has been combined successfully with sulphur, basic copper sulphate, copper oxychloride, and a number of other insoluble copper fungicides. A neutral synthetic cryolite that has very fine particles has proved effective as a dust and as a spray. Neutral cryolite mined in Greenland and ground in the United States is satisfactory as a spray but not as a dust. Of the many imported synthetic cryolites that were tested, some varied in composition and some harmed the plants.

I. J. Becnel gives an account of experiments against the cotton flea-hopper [*Psallus seriatus*, Reut.] in Louisiana, where conditions differ from those in Texas [**27** 380]. The nymphal populations were reduced to equal degrees by dusting sulphur (325-mesh) either alone or mixed with calcium arsenate (2 : 1), with or without 0·5 per cent. Vatsol OS (a sodium alkyl naphthalene sulphonate) as a spreader, but the two mixtures were more effective than sulphur alone against the adults. The final counts showed a greater number of fruiting forms in the treated blocks than in the untreated ones, and the mixtures gave greater increases than sulphur alone.

R. C. Gaines discusses the control of *Anthonomus grandis* on cotton in the light of the work that has been carried out in several States during the past 20 years. Tests in Louisiana have confirmed the view that an adequate number of applications of calcium-arsenate dust still remains the best method of control.

Eddy states that the corn silk beetle, *Monolepta varicornis*, Lec. (*Luperodes brunneus*, Crotch), which in one district has been a pest of maize for over 40 years, occasionally causing total crop loss, is now becoming injurious elsewhere in the State. The beetles destroy the silks, as fast as they grow, thus preventing the maize from setting. They are usually found early in the spring, feeding on sweet gum [*Liquidambar styraciflua*] at the edge of wooded areas. A little later they migrate to maize and other succulent crops. The principal damage is to maize, but cotton is often severely injured by feeding on the bracts and in the small fruit buds. The beetles are easily killed by arsenicals or cryolite, but dusts of nicotine, derris or pyrethrum are less effective. Calcium arsenate can be applied to cotton as for the control of *A. grandis*, but arsenicals should not be used on maize that is intended for fodder. To prevent injury to the maize and poison residue, arsenical dusts should be applied directly and exclusively to the silks ; two or three applications at intervals of 5–7 days are required, depending on rainfall and rate of growth.

E. H. Floyd gives the results of investigations in 1938–39 on the bionomics and control of *Colias eurytheme*, Boisd., the larvae of which occur consistently on lucerne and related crops in Louisiana, though natural checks have prevented serious outbreaks. All stages of this Pierid are described. There were seven overlapping generations in the year ; the winter is passed in the larval stage, though feeding and development continue at a reduced rate. Counts showed that the larval population was lowest in February and July and highest in December. The eggs hatched in 3 and nearly 8 days at average temperatures of 81 and 63°F., respectively, the larval stage averaged 27·1 days in early summer at 81°F. and 69·1 in October at 58°F., at which periods adult longevity averaged 5·2 and 23·5 days, respectively, the prepupal stage lasted 1–3 days and the pupal stage ranged from 5 days in summer to 45 in autumn. Oviposition began 2 days after pairing and continued for 9 days, the number of eggs laid per female averaging 353 and ranging up to 697. *Trichogramma minutum*, Riley, parasitised about 15 per cent. of the eggs in the field, while *Apanteles flaviconchae*, Riley, and *Meteorus autographae*, Mues., were reared from fifth-instar larvae. The Coccinellid, *Ceratomegilla* (*Megilia*) *fuscilabris*, Muls., destroyed a great number of first- and second-instar larvae, and is probably the most effective natural check. A wilt disease killed a few larvae and pupae in the field. Sodium fluoaluminate [cryolite], barium fluosilicate, copper arsenate and calcium arsenate were found in laboratory tests to be highly toxic to fifth-instar larvae. Basic lead arsenate and derris dust (4·1 per cent. rotenone) gave little control.

L. T. Graham and L. O. Ellisor describe further work on the Membracid, *Stictocephala festina*, Say, which girdles the stems of lucerne and other leguminous plants with its feeding punctures [*cf.* **27** 370]. All stages are briefly described. The nymphs secrete honeydew, and the hills of fire ants, *Solenopsis* sp., at the bases of the lucerne plants provide a good indication of their presence. In both 1937 and 1938, there were four complete generations and a partial fifth, and the adults continued to feed and oviposit on warm days in winter.

A. L. Dugas discusses the present status of *Trichogramma* spp. as parasites of *Diatraea saccharalis*, F., on sugar-cane in Louisiana. After briefly surveying the trend of natural parasitism [**28** 241], he states that recent attempts to increase the effectiveness of these parasites has shown the necessity of determining the various species or strains present and reviews the three, or perhaps four, distinct colour forms observed. They differ in abundance, habitat selection, duration of development, fecundity and readiness to parasitise eggs of *Diatraea*. The grey form is the most generally distributed and the most abundant. Yellow forms appear to predominate near areas of woodland and vegetable crops, while a black form appeared to have no preferred habitat and was not numerous. Knowledge of the way in which these parasites pass the winter would aid in carrying through a greater number. Species introduced from California, Georgia, Arizona and Porto Rico have been recovered in small numbers in the two localities in which they were liberated.

J. W. Ingram, W. E. Haley and L. J. Charpentier show in a series of tables the results of investigations in 1937–39 on the effect of lime in reducing injury to sugar-cane by the adults of the Dynastid, *Euetheola rugiceps*, Lec. [*cf.* **28** 247]. The application to the soil in autumn of two tons or more of lime per acre has been found to increase the number of shoots obtained and to reduce somewhat the number of shoots injured by the beetles in the following season. The cane in treated plots had a noticeably darker green colour in spring, and the injured shoots appeared to recover more readily from attack.

Investigations on the percentages of internodes of sugar-cane of different varieties bored by *Diatraea saccharalis* [*cf.* **27** 372] were continued in 1937 by Ingram and Ellisor. Of the 7 varieties under observation, Co 290 had the lowest percentage in both plant cane and first-year stubble, and should be favoured, if agronomically suitable, in localities where borer infestation is normally heavy.

Eddy states that the infestation by the Mexican bean beetle [*Epilachna varivestis*, Muls.] in Louisiana, where it was first recorded in 1938 [**27** 599], covered an area about 4 miles across in 1939. As temperatures of 100°F. or above kill all stages, it is unlikely to be more than sporadically harmful in central and northern Louisiana, but may become established in the south. The best insecticidal treatment that leaves no residue on the plant is a derris or cubé dust containing 1 per cent. rotenone, applied at the rate of 15–25 lb. per acre at weekly intervals when the pest is active. Cryolite at 10–15 lb. per acre can be used until the bean pods begin to form.

K. L. Cockerham describes investigations on the alternative food-plants of the sweet-potato weevil [*Cylas formicarius*, F.] in which plants of more than 100 species were used, including as many wild, cultivated and ornamental plants as possible. The adults fed to some extent on plants of about 20 species, a list of which is given, in the absence of sweet potato, and breeding occurred on 6 species of *Ipomoea* and *Quamoclit vulgaris*. Observations on the flight of *Cylas formicarius* are recorded by O. T. Deen. Adults were collected at lights during every month from April to October, on adhesive screens in June and July, and on all trap patches of sweet potato at distances of up to a mile from a given point of dispersal. They therefore fly much more strongly and readily than was formerly believed. Males fly more freely than females. C. L. Stracener and L. D. Newsom report the results of examinations during the winters of 1938–39 and 1939–40 of more than 480 crowns and 1,600 tubers of sweet potato collected in the field to obtain data on the overwintering of the weevil. A total of 987 larvae, pupae and adults was found, of which 68·2 per cent. were alive. Thirteen infested tubers left in the field throughout the winter were caged in March 1939, and 129 adults had emerged from them by the end of April. Extreme cold cannot, therefore, be relied upon to destroy all the overwintering individuals. Resistance to cold was greatest in the pupae and least in the adults.

Eddy states that considerable injury is caused by the sand wireworm, *Horistonotus uhleri*, Horn, to cotton, maize, cowpeas, most vegetable crops and some grasses from time to time in Louisiana. The eggs are laid in June and July, and the larvae, which hatch in about 12 days, feed on the roots and underground parts of the plants and give rise to adults in the following May–July. The greatest damage is caused by the larvae approaching maturity in May and June. Observations in Louisiana have shown that soy beans, planted early, are the most practical crop to use in the one-year rotation programme required to control or eliminate this Elaterid from soil in which its preferred food-plants have been growing. Leaving infested land fallow for one year is almost as effective, but has not the same agricultural advantages. The velvet bean [*Stizolobium*] and kudzu [*Pueraria hirsuta*] are also favourable crops for rotation, but are less desirable. An effective rotation in preliminary tests was to follow infested cotton or maize with winter oats planted in autumn and then with summer sagrain [a grain-producing sorghum with a sweet stalk] planted not earlier than 10th July. In some instances, the addition of large amounts of organic matter as manure gave adequate control. Eddy also records that the oriental fruit moth [*Cydia molesta*, Busck] was first observed in Louisiana probably in 1935 or 1936 and is now a very destructive pest in the northern and central districts. Large collections of larvae from peach-growing localities have failed to yield any parasites, but *Trichogramma minutum* parasitises over 50 per cent. of the eggs.

Becnel describes experiments showing that strawberry plants can be protected from infestation by the red spider [*Tetranychus telarius*, L.] by a spray of 4 lb. wettable sulphur and 4 lb. Oxo Bordeaux (containing 12·5 per cent. metallic copper) in 50 U.S. gals water. The addition of 4 lb. wettable sulphur to 50 U.S. gals. Bordeaux mixture (4–4–50) was of some value in reducing infestation, but was less effective than dusting sulphur (325-mesh), heavy applications of which during warm weather gave excellent control.

Eddy and Floyd review recent work on the use of contact sprays and dusts against various pests in Louisiana. Several species of Pentatomids attack crops in the State and no really effective method of controlling them has been developed. The most promising material tested against them is a spray of soap at the rate of about 1 lb. to 5 U.S, gals. water, which has given an average of about 50 per cent. control. Two or three applications afford adequate protection to tomatos, beans and some other crops. The addition of pyrethrum, rotenone or nicotine sulphate increases the control only slightly, but a significant increase is secured by adding 1–2 per cent. kerosene. The effectiveness of the spray is also increased by heating it to the point where it is impossible to hold the hand in it. For the control of the squash bug [*Anasa tristis*, DeG.] a 3 per cent. nicotine-lime dust has proved equal or a little superior to the soap spray. This dust is also effective against Tingids and the cotton Aphid [*Aphis gossypii*, Glov.].

SHOTWELL (R. L.). **Life Histories and Habits of some Grasshoppers of economic Importance on the Great Plains.**—*Tech. Bull. U. S. Dep. Agric.* no. 774, 47 pp., 10 pls., 12 figs., 5 refs. Washington, D.C., 1941.

During the period from 1923 to 1937, field and laboratory studies were made on the life-histories and habits of twelve species of grasshoppers commonly found in the northern Great Plains area of the United States. Economically, the most important were *Melanoplus bivittatus*, Say, and *M. differentialis*, Thos., which in 1931 were responsible for the destruction of 25–75 per cent. of all crops over an area of 30,000 sq. miles in South Dakota and Nebraska [*R.A.E.*, A **20** 410]. The blowing of the soil from fields in which maize had been destroyed started in the autumn of 1931 and was the beginning of the Dust Bowl formed in 1934–36. By 1936, an area 5 miles wide and 25 miles long was a waste of swirling dust, although previous to 1931 it had been a rich farming district.

Observations of food-preferences of the grasshoppers showed that they prefer barley, oats, wheat and rye, in that order, with lucerne and maize following. Even when not abundant enough to destroy the foliage, they often do great damage to maize cobs. Other special types of injury due to food preferences are the shattering of oats, the feeding on grains of wheat in the ear while it is in the dough stage, and the cutting off of the heads of wheat and balls of flax. Sorghums are avoided, but attempts to protect crops by planting barriers of sorghum failed. When feeding on trees and shrubs, the order of preference is mulberry, apple, Chinese elm [*Ulmus pumila*], honey locust [*Gleditsia triacanthos*], *Caragana*, box-elder [*Acer negundo*], willow, spruce and poplar ; the green ash [*Fraxinus lanceolata*] is apparently immune.

Tables are given illustrating the seasonal life-histories of the more common species during the 14 years of observations. The date of first hatching varied from 20th April to 6th June, while the first appearance of adults occurred between 30th May and 12th July. For individuals of *M. bivittatus* living under the same conditions, the hatching period may extend over 6 weeks ; at room temperature the average durations of the hopper stage, preoviposition period and adult life were 43·3, 25 and 38 days, respectively. The minimum temperature for hatching was approximately 60°F. for most species. *M. bivittatus* hatched earlier in the season than *M. differentialis*, *M. femur-rubrum*, DeG., or

Dissosteira carolina, L. Hoppers of *Camnula pellucida*, Scud., developed in a shorter period than those of any other species. *M. femur-rubrum* from Montana completed hopper development more quickly than the same species from Tennessee. All stages of *D. carolina* had a higher optimum temperature for development than other species. The rate of development increased rapidly as the temperatures were raised from 70 to 100°F., but above 100° mortality increased rapidly. Hoppers of all species were unable to survive a constant temperature of 59°F., and those of *M. bivittatus* did not mature if exposed immediately after hatching to 50° for more than 8 days or to 59° for 12 days. At high temperatures, the colour patterns of the hoppers and resulting adults are bleached, probably owing to rapid oxidation of pigment.

Changes in the number of antennal joints, length of hind femur, shape of thorax, and structure of wing pads and of posterior abdominal segments during the hopper stages are discussed and figured, and a key for the identification of the instars on the more apparent characters is given. The normal number of hopper instars is five, but in *M. bivittatus*, *M. mexicanus*, Sauss., *Dissosteira carolina* and *Camnula pellucida*, it was occasionally six, the tendency towards an extra instar being more pronounced in females. *M. femur-rubrum* from Montana developed in five instars, while the same species from Tennessee went through six, and six was the normal number for *M. differentialis*. All the species studied hibernated in the egg stage and produced only one generation a year, but eggs of *M. mexicanus* collected in Montana in autumn have been observed to hatch within 3 days when kept at 85°F. Further south, almost a complete second generation of this species has hatched in the field, reached maturity and laid eggs in the late summer and autumn. Eggs, egg-pods and the preferred oviposition sites of the main species are briefly described. The greatest number of eggs in one pod of *M. bivittatus* was 104, with 4 pods as a maximum for one female. Forty females of *M. differentialis* deposited an average of over 300 eggs per female.

The influence of temperature on the activity of the hoppers is manifested in their daily movements. Both hoppers and adults pass the night on plants and move down from them in the morning when the air temperature reaches 68°F.; when the air temperature reaches 90°F., or the soil-surface temperature 113°F., the grasshoppers leave the ground and climb plants, fences, etc. Feeding on poison baits occurs when the air temperatures are between 70 and 90°F. Both hoppers and adults were observed migrating against the wind, without forming swarms, towards fields of green crops, probably following the stream of moist air. The same reaction was observed towards a pan of wet bait, which could attract hoppers from 30–40 feet. Within a large field, a continuous shifting of the grasshopper population is observed, and densities in any one place are subject to great changes. Over a period of 6 days, the population in one plot varied between 52 and 245 per cent. of its original number. The extent of the damage to crops depends on the density of the population, and a table is given showing the estimated numbers of grasshoppers per square yard required to do a definite amount of damage to different crops. A population of 10 per square yard would prevent a new crop of lucerne from developing for 10–14 days after the first cutting. On wheat, an average population of 15 per square yard would result in a loss of 48 per cent.

Cotton (R. T.). **Insects Pests of Stored Grain and Grain Products. Identification, Habits and Methods of Control.**—Demy 8vo, 242 pp. 93 figs., multigraphed, many refs. Minneapolis, Minn., Burgess Pub. Co., 1941. Price $3 (post free for payment in advance).

The first chapter of this book on the insect pests of stored grain and cereal products in the United States contains information on the origin of their mode of life, their distribution, regional abundance and occurrence on cereals in the field in the United States, and notes on the appearance and bionomics of 40 of the commonest species; brief notes on grain mites and on parasites and predators that attack grain insects are also included. The preventive and control measures in use on farms and in elevators and warehouses are described in detail and discussed. The greater part of the book (nearly two-thirds) deals with the control of pests of flour. The sources of infestation and its prevention in flour-mills and the precautions necessary to prevent flour that has left the mills becoming infested during transit or in storage in bulk or in smaller quantities are described. The properties of the fumigants in common use in various countries are surveyed, and instructions for the fumigation of flour mills and warehouses and of flour in atmospheric vaults and vacuum chambers are given at some length. An account of the physiological effect of the fumigants on insects, the factors affecting their efficacy and the susceptibility of insects, and the behaviour of fumigants under various fumigating conditions is included. A final chapter deals with control by means of high and low temperatures and the use of electricity for sterilising cereal products. A bibliography is given at the end of each chapter.

McDaniel (E. I.). **Sprays to control the Scotch Pine Scale,** *Toumeyella numismaticum.—Quart. Bull. Mich. agric. Exp. Sta.* **23** no. 3 pp. 151–152. East Lansing, Mich., 1941.

An account is given of an experiment in Michigan in 1940 with sprays against *Toumeyella numismatica*, Pettit & McD., on jack pine [*Pinus banksiana*]. The infestation had been present for about five years, affected every tree in the stand and was heaviest on the lower branches and from the tips of the twigs back to the three- and four-year-old growth. The sprays tested comprised, all in 100 U.S. gals. water, 4·6 oz. dinitro-ortho-cyclohexylphenol in 1 U.S. gal. oil (viscosities 108, 87 and 52 secs. Saybolt at 100°F.), 4·6 oz. dinitro-cresol in 1 U.S. gal. oil (viscosity 108 secs.) and 8 or 16 oz. dinitro-ortho-cyclohexylphenol or dinitro-cresol and 12 oz. lye (94 per cent. sodium hydroxide), and they were compared with one of 4 U.S. gals. oil (viscosity 108 secs.) emulsified with 100 U.S. gals. Bordeaux mixture containing 8 oz. lime and 8 oz. copper sulphate, which has previously been reported to control *T. numismatica*.

The sprays were applied at a pressure of 600 lb. between 10th and 17th April, when the Coccids were showing signs of life, care being taken to cover the lower branches and tips of the twigs, and estimates of mortality were made on 15th July. It was found that all Coccids that had been hit with any of the sprays were killed, but there were some survivors on occasional branches that had been missed. No injury was caused to the trees, even to those that had been weakened as a result of the heavy infestation.

Scientific Contributions.—*Bull. Bartlett Tree Res. Labs* no. 3, 52 pp., 14 figs., many refs. Stamford, Conn., 1939. [Recd. 1941.]

These reports of the results of investigations carried out by the Bartlett Tree Research Laboratories at North Stamford, Connecticut, or in cooperation with them include several on insect pests of trees and shrubs and their control.

An account is given by E. P. Felt (pp. 20–25) of further releases of toy balloons in 1937 to determine the connection between wind currents and the spread of *Ophiostoma* (*Ceratostomella*) *ulmi*, the fungus that causes Dutch elm disease, by the vector, *Scolytus multistriatus*, Marsh. [*cf. R.A.E.*, A **25** 374]. It includes details of the directions in which the balloons drifted from North Stamford, the distances covered, the rates of drifting and the effect of local conditions on the air currents. It is pointed out that such drift might carry the beetles long distances from an infected area, and that the effect on the drifting individuals of downward currents near expanses of water would favour the occurrence of the disease. The distribution of the balloons agreed in some cases with that of infected elm trees.

Felt and S. W. Bromley (pp. 28–29) briefly describe the life-history of *Phytomyza ilicicola*, Lw., on holly [*Ilex*]. The eggs are laid in the developing leaves, and the larvae mine in the upper surface of the new foliage throughout most of the season ; the pupae overwinter in the mines, and the adults emerge over a period of 10–14 days, beginning about mid-May. The results of laboratory tests with sprays containing nicotine sulphate or lead arsenate have already been noticed [**26** 546]. In field tests in 1937, a spray containing 2 U.S. gals. summer Volck oil, I U.S. pint nicotine sulphate, and 1 lb. lead arsenate in 100 U.S. gals., applied in May when large numbers of adults were emerging from the leaves, gave excellent control.

Investigations in 1937–38 on the club gall of dogwood [*Cornus*], reported by Felt and Bromley (pp. 30–33), confirmed that *Mycodiplosis alternata*, Felt, is the causal agent [*cf.* **26** 546], since over 2,000 galls, kept over winter in cages with sterile soil, gave rise to this Cecidomyiid, and no examples of *Porricondyla* sp. were obtained. When some of the adults were transferred to outdoor cages containing growing dogwood tips, club galls developed later in the year. The eggs are laid near the tips of the young growth, and the infested shoots begin to swell in the second half of June, when the second set of leaves is developing. The galls contain 1–6 larvae, which drop to the ground when full-grown and overwinter in the soil. The adults emerge towards the end of May, but are rarely seen on the plants. Applications of sprays containing 4 lb. resin residue emulsion and 4 lb. cubé powder per 100 U.S. gals. on 14th, 18th and 28th May and 14th June appeared to be effective, since a badly infested tree had no new galls by 7th July and only eight by 10th October.

Felt (pp. 34–35) contributes brief notes on *Dialeurodes chittendeni*, Laing, and *Giardomyia rhododendri*, Felt, on rhododendron. Immature Aleurodids are not easily killed by insecticides, but it has been reported that a 2 per cent. summer oil, applied in early autumn or in spring to the underside of the leaves, has given satisfactory control of *D. chittendeni* [*cf.* also **25** 242]. This spray with the addition of nicotine will kill the adults ; the nicotine should, therefore, be added to any sprays applied between May and August. The most promising treatment against *G. rhododendri*, which occurs in south-eastern New

York and south-western New England [*cf.* **27** 499] but has caused only local injury, is a spray of ½ U.S. pint nicotine, 3 lb. soap and 9 U.S. gals. molasses in 40 U.S. gals. water, applied to the tips of the plants just after new growth starts in spring or midsummer.

A paper on the Aphids of coniferous trees by Bromley (pp. 36–39) includes notes on the bionomics of *Cinara* (*Lachnus*) *sabinae*, Gill. & Palm., which caused considerable injury to ornamental red cedars (*Juniperus virginiana*) in the north-eastern United States in 1928 and 1929 and has caused noticeable damage in most years since [*cf.* **22** 530]. Its colonies were abundant on red cedars at North Stamford in late May, June and early July ; alate migratory forms then appeared and left the trees, which became almost free from infestation, but had browned foliage and dying shoots early in August. What were probably overwintering eggs of this Aphid occurred on the tips of shoots of infested trees in November. *C. strobi*, Fitch, is commonly found on white pine (*Pinus strobus*) throughout the season. The conspicuous overwintering eggs hatch as early as mid-April near Stamford, and the Aphids feed on the smooth bark of the twigs and smaller branches in colonies ranging from a few individuals to some hundreds. The population is usually small during the hot weather, but large numbers may develop during September and persist into November, and many trees, particularly the younger ones, do not survive the winter after a heavy autumn infestation. Certain pines, such as *P. mugo*, *P. densiflora*, *P. nigra* and *P. sylvestris*, may be seriously injured by *Eulachnus agilis*, Kalt., which has also been recorded on *P. halepensis* and *P. pinaster*. This species was erroneously identified as *E. rileyi*, Williams, in earlier work in which it was recorded as a pest of *P. mugo* [**24** 531, 715], but further observations have shown that the true *E. rileyi*, which is common on the needles of red pine [*P. resinosa*], is relatively innocuous, no serious injury due to it having been found on this pine over a period of several years. The Japanese table pine (*P. densiflora umbraculifera*) is badly injured and sometimes killed by Aphids, and colonies of *C. pini*, L., which has also been recorded from *P. sylvestris*, have been observed in autumn on the twigs and branches of trees that were found to be badly injured in the following spring. A similar and possibly identical species has been found in autumn on the bark of the twigs and branches of the Japanese black pine (*P. thunbergi*). The overwintering eggs were deposited on the needles, and light infestations were noted in the following spring. Though growth was retarded, severe injury, such as occurred on the table pine, was not observed. *C. pinicola*, Kalt. (*hyalina*, Koch) is sometimes abundant on the undersides of the twigs of young Norway spruce (*Picea abies*), usually near the tips. No damage due to its feeding has been observed, but it produces honeydew that attracts ants, wasps, and flies. Thorough applications of a contact insecticide when the Aphids are present, but not yet injurious, usually during June against the summer infestation and during September against the autumn one, are recommended for the control of all these species.

Most of the information given by Bromley in accounts of tests with wetting agents for lead arsenate (pp. 40–42) and of work with colloidal lead arsenates (pp. 42–43) was also contained in a paper already noticed [**29** 118]. At the rate of ½ lb. per 100 U.S. gals., colloidal lead arsenate caused some reduction in the feeding of the European willow leaf-beetle [*Plagiodera versicolora*, Laich.], and at the rate of 3 lb. per

100 U.S. gals., it gave results similar to those obtained with standard lead arsenate at the same rate.

FAWCETT (G. L.). **La peste negra de los tomates y la corcova del tabaco.** [The "Black Disease" of Tomato and the "Corcova" Disease of Tobacco.]—*Rev. industr. agríc. Tucumán* **30** no. 10–12 pp. 221–226, 3 figs., 3 refs. Tucumán, 1940.

An account is given of experiments in 1937 in Tucumán, Argentina, showing that the virus of the disease known as corcova in tobacco and black disease in tomato is transmitted by *Frankliniella paucispinosa*, Moult. [*cf. R.A.E.*, A **26** 581]. The virus was transmitted by the thrips from diseased to healthy tomato, from tomato to tobacco and from tobacco to tomato, but transmission was not effected by *Myzus persicae*, Sulz., *Aphis rumicis*, L., *Engytatus notatus*, Dist., *Empoasca* sp., *Eutettix* sp. or beetles of the genera *Epitrix* and *Diabrotica*. The Jassid, *Agalliana ensigera*, Oman,* which transmits the virus of curly top of beet in Argentina, produces symptoms somewhat similar to those of black disease when transferred from infected beet to healthy tomato plants. The symptoms are not pronounced, however, and disappear in a few weeks, indicating that the beet curly top in Tucumán is distinct from the Californian curly top, which attacks tomato as well as beet. The corcova virus was also transmitted between tomato and tobacco by mechanical means. It appears to be the same, to judge from descriptions, as the spotted wilt common in various plants in Australia, Hawaii and South Africa, and as the "vira-cabeça" or crooked top of tobacco in Brazil [*cf.* **28** 638–640; **29** 139–141], both of which are transmitted by thrips.

WALLACE (C. R.). **Notes on a Weevil Species in Lucerne.**—*Agric. Gaz. N.S.W.* **52** pt. 2 p. 88. Sydney, 1941.

Pantomorus taeniatulus, Berg, a weevil that is native to Argentina and also occurs in the United States round the Gulf of Mexico, was first found in Australia in March 1938, when it was taken at Lochinvar (New South Wales). Crops of lucerne there and at Windsor have since been damaged by the larvae, which occur in the soil round the roots of lucerne and couch grass (*Cynodon dactylon*) and feed on the fleshy tissue of the cortex of the tap root of the former. The pupal stage is passed in a cell in the earth. The adults are found in the soil and among the leafy top growth of lucerne, but are not known to damage the plants. They have been taken in September and in January–May, the period of greatest activity being January–March, when larvae and pupae are also abundant.

Insect Pests.—*Agric. Gaz. N.S.W.* **52** pt. 2 pp. 95–99, 116, 12 figs. Sydney, 1941.

This part of a series on insect pests in New South Wales [*cf. R.A.E.* A **29** 493] includes notes on the predacious Clerid, *Trogodendron fasciculatum*, Schreibers, which is widely distributed in Australia

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*In the paper in which he describes this species [*Rev. Ent. Rio de J.* **4** 333–340, 1934] Oman states that this Jassid is the one previously recorded [*R.A.E.*, A **15** 458; **16** 575] as *Agalliana* (*Agallia*) *sticticollis*, Stål [*cf.* also **25** 442,] and that the latter probably does not occur in the sugar-beet areas of Argentina.

and is of considerable importance in the control of wood-boring Lepidopterous and Longicorn larvae. The eggs are probably laid in cracks in the bark or in the tunnels of grubs or caterpillars on which the Clerid larvae feed. The adults, which emerge in October and November and fly by day, can be collected during the summer on native flowers. Eggs laid by a female caught on 12th December 1940 hatched in seven days.

Hylesinus fici, Lea, is an indigenous Scolytid that mines in the terminal twigs of cultivated figs and Australian species of *Ficus* and has been stated to attack the bark and wood of the trees as well. Unhealthy trees are most liable to attack, but healthy ones are sometimes injured. Control measures are difficult to apply, as infestation is seldom detected until most of the damage has occurred, but infested twigs may be cut off and burned. If the trunk and branches are attacked, they might be protected by a repellent paint of copper sulphate.

A brief account is given of the bionomics of *Pantomorus leucoloma*, Boh., its distribution in New South Wales and the damage caused by the larvae and adults to lucerne and some vegetable crops [*cf.* **29** 494]. The eggs are laid in batches at the surface of the soil, and the larvae occur chiefly in the upper six inches of soil and often in a compact earthen cell. They usually feed on the outer, fleshy portion of the tap root, but sometimes damage the central core. The pupal stage is passed in the soil and lasts about a fortnight. The adults sometimes damage plants by feeding on the leaves, but are generally less destructive than the larvae.

JEPSON (W. F.). **Entomological Division.**—*Rep. Dep. Agric. Mauritius 1939* pp. 16–19. Port Louis, 1941.

In 1939, searches were continued in foreign countries [*cf. R.A.E.*, A **28** 303] for parasites of Lamellicorns suitable for introduction into Mauritius for the control of *Lachnosterna* (*Phytalus*) *smithi*, Arr., on sugar-cane, and attention was concentrated on Tachinids that parasitise the larvae and adults. Seven shipments of *Pexopsis pyrrhaspis*, Villen., were received from Natal, and ten of *Dexiomorpha picta*, Mg., from Morocco [*cf.* **29** 83]. *Microphthalma sejuncta*, Wlk. (*capensis*, Schin.) was received in large numbers from South Africa and was successfully bred in the laboratory on *L. smithi*, the number of pupae obtained per host larva averaging 2. Two shipments totalling 2,462 pupae of the Ortalid, *Adapsilia latipennis*, Wlk., were received from South Africa, but almost all died owing to the change in climate. Four consignments of the European *Dexia rustica*, F., were received from England.

The cyclone of March 1939 was disastrous to Scoliid parasites in Mauritius, and regular distribution to planters was considerably reduced. Ten colonies, each of 200 females, of *Campsomeris phalerata*, Sauss. [*cf.* **28** 303] were liberated. Cane varieties showing resistance to *L. smithi* were distributed to planters for trial in infested fields, and the giant toad, *Bufo marinus*, was systematically liberated. No evidence was obtained that any of the imported Tachinids had become established.

A preliminary survey for parasites suitable for introduction into Mauritius for use against *Diatraea* on sugar-cane was made in Ceylon by J. Vinson. In six months he obtained only 11 larvae of *Diatraea* in an area of about 150 acres of cane. The moth-borer that is common in cultivated and wild grasses in Ceylon is *Chilo zonellus*, Swinh., and parasites bred from it comprised *Xanthopimpla stemmator*, Thnb., from the pupae, and *Microbracon* (*Bracon*) *albolineatus*, Cam. (the most promising), *Apanteles flavipes*, Cam., and *Macrocentrus* sp. from the larvae. *M. albolineatus* was bred in the laboratory on larvae of *Diatraea* and *Sesamia*, and 2,528 individuals were liberated in twelve infested cane fields in Mauritius from April to December. *X. stemmator* was also released, and it has been recovered in one locality. A colony of *Trichogramma* obtained from the Tea Research Institute in Ceylon was bred in eggs of *Ephestia* sp. and other moths, and 30,000 were liberated in fields infested with *Diatraea*. The Eulophid, *Trichospilus pupivora*, Ferrière, which parasitises pupae of many Lepidoptera, was also imported from Ceylon. It was found from laboratory breeding that it attacks pupae of *Sesamia*. Over 100,000 individuals have already been liberated on cane, tobacco and lawns. Its life-cycle lasts 18 days in summer and 31 in winter.

Fumigation of the government tobacco warehouse with hydrocyanic acid gas generated by the pot method gave good control of *Lasioderma serricorne*, L., and proved more satisfactory than the use of Cyanogas calcium cyanide [*cf.* **28** 587], since the evolution of the gas was more rapid and complete.

The Javan Coccinellid, *Chilocorus politus*, Muls. [which is predacious on *Aspidiotus destructor*, Sign. (*cf.* **27** 611)] is now widespread in coconut plantations, and a great improvement in their condition is attributed to it. *C. nigritus*, F., was imported from Ceylon and has already been recovered. *Dirhinus auratus*, Ashm., and *Spalangia* sp. were also imported from Ceylon, where they are reported to parasitise fruit-flies. Breeding of the former in the laboratory in Mauritius on local fruit-flies was begun, and the 80 examples of the latter that survived the journey were nearly all liberated in the field. The various importations of beneficial insects carried out during the year are summarised in a table.

MAMET (R.) & DUROCHER-YVON (F.). **La lutte contre les termites à Maurice et l'application de l'arsenic pour combattre ces insectes.**—*Rev. agric. Maurice* **20** no. 1 pp. 59–61, 1 ref. Port Louis, 1941.

In view of the damage that is caused by termites to structural timber in buildings in Mauritius [*cf. R.A.E.*, A **25** 94], the authors have carried out investigations on a suitable insecticide. They found that complete mortality of most of the species concerned was given by a finely ground mixture of 40 per cent. arsenic trioxide, 5 per cent. potassium antimoniate, 2 per cent. borax and 53 per cent. jeweller's rouge (ferric oxide). The antimony and borax are both toxic to termites, but the greatest mortality is given by the arsenic. The mixture should be kept dry and should be blown into the tunnels and nests in fine weather. As a rule, a single application of 5–10 gm. is sufficient, but if necessary another should be made after 10 days.

BREDO (H. J.). **Les termites.**—*Essor agric. Katanga* February 1941 repr. 9 pp. [Elisabethville] 1941.

This paper, which consists chiefly of an account of the distribution, bionomics and control of termites, with instances of the injury they have caused in various parts of the world, includes lists of trees that occur in the Belgian Congo of which the timber is reputed to be more or less resistant to attack and of some 20 species of termites recorded from Katanga or neighbouring parts of Africa, showing the crops and other products that some of them injure. In connection with the first list, the author states that conclusions from experiments on the resistance of timber to termites may be vitiated by the fact that susceptible wood buried in termite nests has been observed to remain free from attack, since the termites do not feed on wood that forms an integral part of the nest.

LUNDIE (A. E.). **The Small Hive Beetle,** *Aethina tumida.—Sci. Bull. Dep. Agric. S. Afr.* no. 220, 30 pp., 9 pls., 4 refs. Pretoria, 1940. Price 3*d*.

An account is given of observations at Pretoria on the bionomics of *Aethina tumida*, Murray, which has been found in bee-hives in parts of South Africa. This Nitidulid was described in 1867 from Nigeria, and was recorded from Durban in 1920, but there is apparently no earlier record of its occurrence in bee-hives. It is probably widely distributed in tropical and sub-tropical Africa and is apparently commoner in the warmer areas of South Africa. Though not a major pest, it sometimes becomes almost as harmful as *Galleria mellonella*, L. The adults collect mostly on the rear portion of the bottom board of the hive, where they can easily feed on the pellets of pollen that fall from the cluster of bees above, and are relatively free from interference. The larvae are particularly troublesome in weak colonies and in combs in storage. They feed on honey and pollen, and though they damage the comb, are less destructive than those of *G. mellonella*.

All stages of *A. tumida* are briefly described. The eggs are laid in irregular masses, preferably in cracks and crevices, and pupation occurs in the soil beneath the hive. In breeding experiments, in which the Nitidulid was successfully reared in small tin boxes at room temperature, the egg, larval and pupal stages lasted 2–3, 10–16 and 21–28 days, respectively, and the adults survived for over six months. Five generations developed in the course of the year, but oviposition did not occur from mid-April to mid-August. The number of eggs deposited by a single female was not ascertained, but two or three beetles in a pile of supers can cause a heavy infestation. The larvae did not mature when supplied with honey only, but developed as rapidly on pollen as on a mixture of pollen and honey. No evidence of parasitism was obtained, and although females of *Microbracon brevicornis*, Wesm., which parasitises the larvae of *G. mellonella*, readily inserted their ovipositors into larvae of *A. tumida*, no parasites were reared from these larvae, all of which died on the second or third day after being stung.

Stored combs that are heavily infested with larvae of the Nitidulid can be fumigated with carbon bisulphide at a minimum dose of 1 oz. to three deep Langstroth hive bodies. Combs that are only lightly infested can be returned to the bees to be cleaned, but those with heavier infestations should first be washed with a hose. Although the bees rarely succeed in ejecting the adult beetles from the hive, they have no great difficulty in removing the larvae from the combs.

du Plessis (C.) & Nolte (M. C. A.). **Laboratory Experiments on the Improvement of Poison Baits for Hoppers of the Red Locust : 1936–37.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 227, 44 pp., 14 refs. Pretoria, 1941. Price 3*d*.

Following field experiments in 1935–36 on the use of poisoned baits against hoppers of *Nomadacris septemfasciata*, Serv. [*cf. R.A.E.*, A **28** 141, 142] investigations were carried out in 1936–37 in a laboratory in Pretoria on possible attractants or repellents for the hoppers and substitutes for sodium arsenite.

The following is based on the authors' summary. Various plant materials and chemicals were subjected to palatability tests, pieces of green maize leaf cut to a standard size and dipped in or sprayed or dusted with the substance being used as the medium, and similar pieces dipped in distilled water as a control. These were given to hoppers confined in celluloid enclosures, and the area of maize leaf consumed was taken as a measure of the palatability of the substance. The results are shown in tables. No plant material or chemical tested was found to render the maize leaves more palatable, but cotton leaves were more attractive than maize. The palatability of the maize leaves was reduced by the essential oils of orange, lemon and *Tagetes minuta*, steam distillates of the leaves of oleander, tobacco, *Casuarina* and papaya, and solutions containing 5 per cent. glycerine, 2 per cent. salt (sodium chloride), 2 per cent. hydrochloric acid, 1 per cent. acetic acid or 2 per cent. sodium bicarbonate. Of the poisons tested, all sodium-arsenite solutions and 2–5 per cent. solutions of calcium chloracetate rendered the maize leaves less palatable, as also did 5 per cent. sodium arsenite and 5 per cent. white arsenic in wheat flour dusted on to moistened maize leaves. Wheat flour alone had no effect. No poison applied in wheat flour or some other inert carrier made the leaves more palatable than those dusted with the carrier alone. Poisons that made no perceptible difference when applied in wheat flour were 5 per cent. calcium chloracetate, 5 per cent. Paris Green, 2 per cent. copper arsenate and 2 per cent. lead arsenate (acid and basic).

Conflicting results were obtained in experiments with potential taste improvers, in which 7 per cent. molasses, 1 per cent. saccharine, 1 per cent. amyl acetate and 5 per cent. glycerine were added in turn to 2 per cent. suspensions of Paris Green and white arsenic and 2 per cent. solutions of calcium arsenite and sodium arsenite. No convincing taste improver was found. The addition of 3 per cent. sugar to 2, 5, 7 and 10 per cent. solutions of sodium arsenite gave no increased consumption.

In a further attempt to use sugar as a taste improver, mortality tests were conducted with baits in which maize-ear meal was the carrier and 2, 5, 7 and 10 per cent. sodium arsenite, Paris Green, white arsenic or sodium arsenate the poison. The baits were tested alone and with 3 per cent. cane-sugar. Baits containing 3 per cent. sodium arsenite, but with maize-ear meal and sawdust in varying proportions as the carrier, and used either alone or with 4 per cent. sugar were also investigated. In no case did the presence of sugar increase mortality, and it can therefore be disregarded as a taste improver. There was no significant difference in effectiveness between 2 per cent. sodium arsenite and the other poisons or concentrations tested, and mixtures of sawdust and maize-ear meal were as effective as carriers as maize-ear meal alone. An attempt to estimate the palatability of baits of sodium arsenite, alone or with 3 per cent. sugar, by noting the time spent by individual hoppers in feeding on the bait, gave inconclusive results.

Mortality tests were also conducted to find a possible substitute for sodium arsenite in poison baits. Apart from some of the arsenicals (Paris Green, white arsenic, copper arsenate, pyro-arsenic acid and calcium arsenate), which proved about as effective as 2 per cent. sodium arsenite, the only substance of promise was calcium chloracetate, which gave fairly rapid mortality and did not deteriorate easily. Baits containing 5, 7 and 10 per cent. calcium chloracetate were as effective as one of 2 per cent. sodium arsenite, and those containing 2 per cent. were usually, though not always, as effective. The results in field tests, however, were inconsistent. A further 18 possible substitutes were tested, but gave very low mortalities in preliminary trials.

LEA (A.) & NOLTE (M. C. A.). **Laboratory Experiments on Poison Baits for the Brown and the Red Locust : 1937-38.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 230, 56 pp., 25 refs. Pretoria, 1941. Price 6*d*.

Laboratory tests were conducted in South Africa in 1937–38 to find possible substitutes for sodium arsenite for use in baits against *Locustana pardalina*, Wlk., and *Nomadacris septemfasciata*, Serv. [*cf.* preceding abstract and *R.A.E.*, A **28** 141, 142]. Relatively large numbers of hoppers were allowed to feed for a definite period on a known quantity of bait, spread evenly on the floor of a celluloid enclosure. To ensure the bait being taken in competition with normal food, fresh grass was supplied immediately before it was spread. Two samples of 25 hoppers each were removed after half an hour, and mortality was observed at 24-hour intervals. It was estimated that the rate of mortality was an indication of the gross effectiveness of the bait, taking into account both toxicity and palatability. A standard bait of 1 per cent. sodium arsenite was included in each experiment in addition to untreated controls, which gave some indication of the health of the hopper material. The data are analysed statistically, the effectiveness of a bait being estimated from the rate and ultimate percentage of mortality in the sample cages, as compared with those obtained with the standard bait.

Among materials tested, particular attention was paid to organic non-arsenical compounds, though white arsenic was also tested, in view of its relative harmlessness to vegetation and to the hands of persons spreading the bait. From experiments carried out on hoppers of both species with white arsenic and calcium chloracetate [*cf.* preceding abstract], it was concluded that between 2 and 3 times the weight of the former, and more than 3 times the weight of the latter, would be needed to obtain a bait as effective as one containing 1 per cent. sodium arsenite. Experiments on mixtures of the two poisons were largely inconclusive, though the addition of calcium chloracetate to a white-arsenic bait apparently increased its effectiveness.

In tests of potential "taste improvers," which were made on *Locustana* hoppers, sugar and salt (sodium chloride) gave inconclusive results [*cf.* **28** 141 and preceding abstract], sodium bicarbonate proved definitely repellent in white-arsenic and calcium-arsenite baits, and potassium acid phosphate and disodium phosphate had no significant effect on attractiveness.

Various modifications of the standard technique, such as varying the moisture content of the bait and the amount of grass fed to the hoppers, and increasing or decreasing the dosage of bait per acre or the amount of poison in it, were tested on *Nomadacris*, but it was concluded that the standard technique was probably as good an approximation to field conditions as could be obtained in the laboratory.

Finally, about 28 non-arsenical compounds were tested, some on both species. All were less effective than 1 per cent. sodium arsenite, except 5 per cent. thallous sulphate [*cf.* **27** 134], which was more toxic but is too expensive to use. Next in order of effectiveness were 5 per cent. cuprous cyanide, which is not recommended owing to its probable high toxicity to mammals and its liability to decompose in bran, and 3 per cent. calcium chloroacetate, which was thought to be the most suitable substitute for sodium arsenite, though field trials were disappointing [*cf.* preceding abstract]. Barium chloracetate and barium bromacetate were slightly less effective than the corresponding calcium salts and did not offer any advantages. Dimethylglyoxime was moderately toxic at 5 per cent. on one of two tests, but in the other it failed completely. Observations on the feeding by individual *Nomadacris* hoppers on calcium-chloracetate bait showed that it is fairly toxic to older hoppers. This bait appears less repellent than sodium arsenite, which, together with its moderately high toxicity, might account for the good results obtained.

OMER-COOPER (J.), WHITNALL (A. B. M.) & FENWICK (E. M.). **The Problem of South African Turf in Relation to invertebrate Pests.**—*S. Afr. J. Sci.* **37** pp. 273–284. Johannesburg, 1941.

Turf rarely occurs naturally in South Africa, and is chiefly composed of indigenous grasses in a new environment ; its pests, though native, are new as pests of turf and require active control. As little is known of the species that are actual pests and still less of those that are potentially harmful, investigations are being carried out on them, and the knowledge so far gained is recorded in this paper.

Of the Lamellicorns, a species of *Macrophylla*, possibly *M. nigricollis*, Pér., does extensive damage on golf courses. When the larvae are abundant, the entire root system may be destroyed, but the damage is frequently not apparent until after a dry period, usually in November and December. The adults occur from January to March and fly just before sunset, but those observed on the wing and taken in light-traps have been exclusively males. The females are rarely seen, but one or two have been taken on the surface surrounded by males and one was taken in March 1939 at a depth of 3 ft. in the soil, where it had oviposited. Larvae in all stages of development have been observed in the soil, but the authors have not seen the pupae. The best measures against the larvae were surface applications of lead arsenate, depth application of a soil fumigant containing paradichlorobenzene, and soil injections with carbon bisulphide. A closely related unidentified species of *Macrophylla* causes similar damage, but differs in habits. The males fly after rains about mid-January and are on the wing for only a few days in succession from about 10 a.m. to 4 p.m. The females do not fly, but crawl about for short periods and then burrow into the ground, followed by several males. Carbon bisulphide has given successful control of the larvae, and the females can be collected and destroyed. *Anomala vetula*, Wied., has been found in large numbers on greens, and as the larvae feed on grass roots they might assume the status of a pest. *Hybosorus illigeri*, Reiche, one of the commonest Lamellicorns in South Africa, was taken in large numbers from turf in the northern Transvaal. Opinions differ as to its food, but infested turf was considerably improved by treating it with lead arsenate or a soil fumigant. Larvae of *Heteronychus tristis*, Boh., retard normal growth by feeding on the roots. Soil fumigants were more effective against them than lead arsenate.

The larva of the Hepialid, *Gorgopis libania*, Stoll, makes a vertical tunnel in the turf, sometimes a foot deep. It spins a web on the surface, under which it attacks the grass, making well defined runs. Later it closes the mouth of the tunnel with a cap and pupates. The larvae or pupae can be killed by piercing the tunnels with a sharpened wire, or by pouring oil into them.

The Lygaeids, *Nysius natalensis*, Evans, and *Geocoris moderatus*, Montd., have been found together in great numbers, and their presence has been associated with poor turf, which has been improved by treatment with an insecticide such as derris. The mole-cricket, *Gryllotalpa africana*, P. de B., damages putting and bowling greens by its mounds and burrows. Injections of powerful soil fumigants have given control, but lead arsenate has not. Infestation by a Tetranychid mite of the genus *Stigmaeus* causes a hypertrophy in the grass shoots, the growth taking the form of elongated rosettes in which the leaves are much reduced in size and overlap closely. All stages of the mite are found at the bases of the leaves. Fumigation with a cyanide preparation was the only measure showing promise of control.

Other pests of turf, dealt with very briefly, include the ants, *Tetramorium sericiventre*, Emery, subsp. *continentalis*, Forel, and *Pheidole punctulata*, Mayr, which are occasionally troublesome, and termites, which are a serious menace.

SMIT (B.). **The Control of Cutworms in Farm Lands and Gardens.**—*Fmg in S. Afr.* 1940 repr. no. 77, 2 pp. Pretoria, 1940.

Cutworms of several species are serious pests of a variety of plants in many districts in South Africa and sometimes completely destroy crops of young maize and beans. Larvae of the first generation frequently develop on weeds that appear after the spring rains. They are buried when these weeds are ploughed in, but later come out of the ground and attack maize that has sprouted or vegetables that have been planted out. Control can be effected by winter ploughing, which destroys the full-grown larvae and pupae in the ground, and by keeping fields free from weeds in spring by ploughing and systematic cultivation so that the moths of the overwintered generation do not fly to them for oviposition. Fields should be kept clear for 45 days before planting or 35 days before sowing maize. When these methods are not practicable, poison-baits can be used. Formulae are given for baits made of green plant material, which are more attractive than bran baits, and one of chopped prickly-pear [*Opuntia*] poisoned with sodium fluoride [*R.A.E.*, A **13** 39] is particularly recommended as it is not dangerous to stock and is more attractive to cutworms than baits containing arsenicals.

LANGRONIER (C.). *Ceratitis capitata* **dans les oasis sahariennes.**—*Bull. Soc. Hist. nat. Afr. N.* **31** no. 7–9 pp. 157–159. Algiers, 1941.

Ceratitis capitata, Wied., was observed in 1937 at El Goléa, a Saharan oasis about 430 miles south of Algiers and over 180 miles south of the southernmost point in the district in which it had previously been found. The larvae appear in apricots, peaches and plums between the end of May and mid-June, attack the summer and autumn crops of figs, and infest fruits of mandarin orange and grapefruit in October and November. Less injury is caused to later varieties of *Citrus*. It is thought that this Trypetid was introduced into the oasis some ten years ago with plants having earth round the roots. Attention is drawn to the serious effects of a possible spread of infestation to date palms.

NICOL (J. M.). **Insect Infestation of Cacao Beans in the producing Countries, with a Note on the Extent to which** *Ephestia elutella* **Hub. and** *E. cautella* **Wlk. establish themselves in Warehouses and Factories in Great Britain.**—*Bull. imp. Inst.* **39** no. 1 pp. 17–25, 7 refs. London, 1941.

A survey to determine the sources of insect infestation in the producing countries of cacao beans for export to London was carried out in 1936–39 by inspection of samples taken, by methods described [*cf.* *R.A.E.*, A **27** 638], in Ceylon, the Gold Coast, Trinidad, Grenada, Brazil and Venezuela. The results showed that attack usually begins at a very early stage in the progress of the cacao beans from the growing areas to the coast ; in 19 out of 25 series of samples it began on the estate premises, and in only two was it delayed until the cacao reached the port of shipment. *Ephestia cautella*, Wlk., and *E. elutella*, Hb., were responsible for most of the damage, other species being of little importance. It is stated that all identifiable specimens of *Ephestia* from West Africa were *E. cautella*, whereas the majority from the American countries were *E. elutella*, with a small proportion of *E. cautella*. The actual records of infestation, however, given for 24 samples, show the occurrence of both species only in samples from Ceylon [*cf. loc. cit.*], *E. elutella* alone in those from Venezuela and Brazil and *E. cautella* alone in those from Grenada and Trinidad. *Corcyra cephalonica*, Staint., was found in samples from Venezuela and the Gold Coast. It had not previously been recorded from cacao in the Gold Coast and had probably migrated from stored rice. *Mussidia nigrivenella*, Rag., was found in one series of samples from the Gold Coast.

Araecerus fasciculatus, DeG., is common and injurious in the Gold Coast [*cf.* **22** 618], but does not seem to survive the winter in Britain. *Lasioderma serricorne*, F., may cause considerable damage and was found on samples from all countries except Ceylon. Both *Ahasverus* (*Cathartus*) *advena*, Waltl, which was present in small numbers in samples from Venezuela, Nigeria and Ceylon, and *Carpophilus dimidiatus*, F., which was fairly common in small numbers, and numerous and destructive in the very mouldy samples from Brazil, are attracted by mouldy food-stuffs. Other Coleoptera of little importance in cacao were *Tribolium castaneum*, Hbst., *Oryzaephilus surinamensis*, L., *Laemophloeus* spp., and *Ptinus tectus*, Boield. *Microbracon hebetor*, Say, attacking *Ephestia* spp., and an unidentified Bethylid parasitic on *Lasioderma serricorne* were also obtained.

Collections of moths from cacao warehouses and chocolate factories in Britain showed that *E. elutella* was the predominant species in the warehouses, and *E. cautella* in the factories. *E. cautella* was also numerous in the warehouses, but its predominance in the factories suggests that it is probably the less hardy species, and so is favoured by the warmer conditions prevailing there. Since the two species can both breed in Britain and appear to be of equal importance there as pests of cacao, it is emphasised that cleanliness and precautions against moths are necessary in cacao stores in all exporting countries, particularly in the tropics, and that damaged and germinated beans, which are most open to attack by insects, should be reduced to a minimum.

BOVEY (P.). **Un moyen de lutte efficace contre l'anthonome d'hiver du poirier** (*Anthonomus pyri* **Kollar**=*A. cinctus* **Redt.**).—*Rev. hort. suisse* 1940 no. 11 repr. 5 pp., 5 figs., 7 refs. [Geneva] 1940.

The author reviews work on the biology of *Anthonomus piri*, Koll., on pear [*R.A.E.*, A **27** 632, etc.] and on its control in Germany by means of a pyrethrum spray applied in autumn against the adults before they have oviposited [**26** 762]. In experiments in the Swiss canton of Valais, a spray containing pyrethrum and soap applied to the trees in early October 1938 considerably reduced the percentage of buds infested in April 1939, and an appreciable residual effect was still visible in the spring of 1940. It is recommended that the trees should be sprayed in the second half of September, and that care should be taken thoroughly to wet the young twigs. If infestation is serious, a second application may be advisable after eight days.

ZAZHURILO (V. K.) & SITNIKOVA (G. M.). **Natural Ways of Transmission of the Winter Wheat Mosaic Virus.**—*C. R. Acad. Sci. URSS* (N. S.) **29** no. 5–6 pp. 429–432, 4 refs. Moscow, 1940.

Investigations in 1935–39 in the Province of Voronezh on the mosaic disease of autumn-sown wheat [*cf. R.A.E.*, A **29** 15] showed that spring-sown wheat, barley and oats are infected but slightly or often not at all. The degree of infection in spring-sown cereals was directly correlated with its prevalence in autumn-sown wheat, which indicates that this crop is the main, and possibly the sole, source of the disease in spring cereals. Winter crops sown early (1st September) were more infected than those sown late (15th September), but in the case of wheat sown in spring (24th April or 5th May) the reverse was observed. The authors believe this to be connected with the bionomics of the vector, *Laevicephalus* (*Deltocephalus*) *striatus*, L. This Jassid has three complete generations a year and hibernates in the egg stage on winter plants. In the Province of Voronezh, the insects of the overwintered generation usually begin to hatch in late April or early May and migrate from winter to spring-sown cereals in the second half of May. In 1939, they became most abundant at the beginning of June, and the first generation developed in July and August on late-sown spring crops and on weeds (*Setaria*, etc.) in fields from which winter and early-sown spring crops had been harvested. The second-generation leafhoppers, which hatched in autumn, occurred chiefly in stubble and plots overgrown with weeds, but some migrated to autumn-sown wheat and rye as soon as these appeared above the ground.

The overwintering generation of the Jassid is of no importance in the infection of winter crops, as the plants are fairly advanced in development when the nymphs hatch, and the disease, which has an incubation period of 15–18 days, cannot manifest itself. Individuals of the first generation become infected on the winter or spring crops and are still present in the field when the autumn-sown plants appear above ground. Their chief importance, however, lies in the fact that they transmit the virus to self-sown cereals, which serve as sources of infection for the Jassids of the second generation. These appear to be the most important in the infection of winter crops, the critical period for the plants being from germination till the advent of lasting frosts.

In the case of spring-sown cereals, the critical period extends from germination to the formation of the stem, and only the overwintering generation of the Jassid, which becomes infected while still on the winter crops, is of importance for infecting them. Early sowing in spring would, therefore, safeguard the crops from the disease. The main object of control, however, is to prevent the infection of winter wheat and, though this is of less importance, winter rye, by reducing the abundance of the vector and of the sources of infection. For this purpose fallow land, especially that near fields of winter crops, should be ploughed early, winter crops should be sown late, and weeds and self-sown cereals should be destroyed.

In 1939, the increase of the Jassid was checked to a certain extent by the parasite, *Pipunculus silvaticus*, Mg.

[BELANOVS'KIĬ (I. D.).] **Белановський (І. Д.). Hessian-fly Parasites in the Ukrainian SSR and their Rôle in the Control of the Hessian-fly in 1937 and 1938.** [*In Ukrainian.*]—Demy 8vo, 88 pp., 49 figs., 55 refs. Kiev, Inst. Zool., Akad. Nauk URSR, 1940. Price 4 *krb.* (With Summaries in Russian and English.)

In view of serious outbreaks of *Mayetiola destructor*, Say, in the Ukraine in 1936 and 1937, a study was undertaken in 1937–38 of its parasites and of their importance in its control. For this purpose, 185,213 puparia of the fly were collected, mostly in the Ukraine but including some from the northern Caucasus, and kept in the laboratory. The great majority of the larvae diapaused, and adult flies or parasites were obtained from only 12,884 puparia (6·96 per cent.), of which 4,797 (37·2 per cent.) were parasitised. However, dissection showed that, with the exception of *Trichacis remulus*, Wlk., the parasites continued to develop in the diapausing host larvae, and that the actual percentage of puparia parasitised did not exceed 8. The 21 parasites obtained included the Eulophid, *Syntomosphyrum* sp., the Encyrtid, *Cheiloneurus elegans*, Dalm., the Miscogasterid, *Miscogaster* sp., the Scelionid, *Trissolcus simoni*, Mayr, the Ceraphronid, *Ceraphron* (*Calliceras*) *vagans*, Kieff., the Platygasterid, *Platygaster zosine*, Wlk., the Pteromalids, *Amblymerus* sp., and *Halticoptera aenea*, Wlk., and the Cynipid, *Eucoila* (*Rhoptromeris*) *eucera*, Htg., none of which has previously been recorded as a parasite of *M. destructor* in the Russian Union, though the last two have been reared there from *Oscinella* (*Oscinis*) *frit*, L. The other species were the Platygasterids, *Trichacis remulus* and *Platygaster hiemalis*, Forbes (*minutula*, D. T.), the Pteromalids, *Meraporus crassicornis*, Kurdj., *Merisus destructor*, Say, *Eupteromalus micropterus*, Lind., and *Callitula bicolor*, Spin., the Eupelmids, *Eupelmus microzonus*, Först., *E. atropurpureus*, Dalm., and

Eupelmella vesicularis, Retz., the Eulophids, *Pleurotropis metallica*, Nees, and *Tetrastichus carinatus*, Forbes, and the Aphelinid, *Centrodora speciosissima*, Gir.

A key is given to the adult parasites, followed by detailed descriptions of the individual species (including the hitherto unknown male of *Ceraphron vagans*) and notes on their bionomics.

The hibernating puparia of the fly on the winter crops and self-sown cereals were parasitised chiefly by *Platygaster hiemalis* and *Meraporus crassicornis*, both of which are widely distributed in the Ukraine. The former apparently has two generations a year and may also attack the summer generations of *Mayetiola*, since in the laboratory adults emerged from the end of May until the second half of September. *Meraporus crassicornis* probably has several generations a year, but is not important as a parasite of the summer generations of the fly. The adults of these species survived for up to 13 and for 27–60 days, respectively, when supplied with raisins and water.

All the other parasites obtained attacked the spring and summer generations of the fly. The most important were *Eupteromalus micropterus*, *Merisus destructor* and *Tetrastichus carinatus*, which were bred from 44·2, 21·8 and 16·31 per cent., respectively, of the parasitised puparia. A few examples of *E. micropterus* were obtained from the hibernating puparia. The adults survived for up to 6 weeks when fed on raisins and water, and the larvae became full-fed in 7–11 days in June and July, but often remained in that state for several months. *M. destructor* probably has two generations a year, the adults appearing in late spring and again in late summer, when they oviposit in puparia in the stubble. *T. carinatus* was bred from puparia from all parts of the Ukraine, except the extreme south, but its distribution was very uneven. Other species that are considered worth investigating were *Pleurotropis metallica*, which chiefly occurred in the eastern part of the Ukraine, and *Trichacis remulus*. The latter is a solitary parasite and has only one generation a year ; the adults emerged in the laboratory from October till mid-December and lived for up to 15 days. It is suggested that further search be made for *Syntomosphyrum* sp., which was reared in considerable numbers, but only from puparia collected in July in the stubble of winter wheat in one locality in the northern Caucasus, and might be of value in southern Ukraine. The author considers that all these species are primary parasites of *Mayetiola destructor*, though some of the Chalcidoids are not specific in their host-relations and also act as hyperparasites.

JAYARATNAM (T. J.). **A Study of the Control of the Coconut Caterpillar (*Nephantis serinopa* Meyr.) in Ceylon with special Reference to its Eulophid Parasite, *Trichospilus pupivora* Ferr.**—*Trop. Agriculturist* **96** no. 1 pp. 3–21, 3 pls. (1 col.), 2 figs., 6 refs. Peradeniya, 1941.

Nephantis serinopa, Meyr., is the only important Lepidopterous pest of coconut in Ceylon and periodically causes severe damage in areas on the east and west coasts. The author gives a brief account of outbreaks since 1900, when it was first observed in the Batticaloa district, and of attempts to control it. It has been recorded on a number of other palms. The adults are active at night. The females begin to oviposit about two days after emerging, and deposit up to 350 eggs in batches, usually on the lower surfaces of the leaflets, over a period of 4–10 days.

The larvae hatch in about 6–10 days and feed on the lower surface of the leaflets, forming protective galleries over the mid-ribs with small pieces of leaf tissue and pellets of waste matter. They pupate in cocoons, usually spun on the underside of the leaflets. The larval and pupal stages last 5–8 weeks and 7–13 days, respectively, and 6 generations occur in the year.

One of the most important natural enemies of this Tineid is *Trichospilus pupivora*, Ferrière, which parasitises the pupae. This Eulophid is indigenous on the west coast of Ceylon and in South India [*cf.* *R.A.E.*, A **22** 261], and also occurs in Malaya and Java. An account is given of attempts to establish it in districts in South India in which it did not previously occur, and on the east coast of Ceylon [*cf.* **28** 563, etc.], where the climate is much drier than on the west coast. A table shows the recoveries that were made in 1938 and 1939 on estates on the east coast in which the Eulophid had been liberated, but it is considered that the prospects of its becoming established there are poor. There is no evidence of its establishment in dry areas in South India.

The females of *T. pupivora* are apparently normally fertilised within the host pupa, as pairing was never observed when the parasites emerged naturally but always occurred immediately after they were liberated from the host pupa by artificial means. One male fertilised a large number of females, which began to oviposit within 2–6 hours of emergence and died 3–6 days later. They oviposited in several pupae, depositing a number of eggs in each, and attacked pupae as much as eight days old, but not parasitised pupae when unparasitised ones were available. Unfertilised females did not oviposit. Averages of 91 and 96 parasites emerged from pupae collected in the field in two localities. The egg, larval and pupal stages lasted 1, 7–8 and 8–9 days, respectively, and in the laboratory the average life-cycle was about 17–20 days, 17–22 generations being completed in the year. In the field, *T. pupivora* has also been reared from *Tirathaba* spp. in Java, *T. rufivena*, Wlk., in Malaya, and *Sylepta derogata*, F., in South India, and from a Tachinid parasite of *Nacoleia annubilata*, Swinh., and the species of *Stomatomyia* mentioned below, and possibly from *Thosea cervina*, Moore, and *Spodoptera mauritia*, Boisd., in Ceylon. It has been reared on a number of hosts in the laboratory in South India [*cf.* **22** 262] and Ceylon [**28** 97], and the technique of breeding it in the laboratory at Peradeniya is described ; 84 generations have been bred uninterruptedly, and it has been possible to distribute 1½ million examples per month for liberation.

In addition to *Trichospilus pupivora*, there are several indigenous natural enemies of *Nephantis* in South India and Ceylon. Those that occur in South India comprise *Perisierola nephantidis*, Mues., *Apanteles taragamae*, Vier., *Microbracon brevicornis*, Wesm., and *Elasmus nephantidis*, Rohw., which parasitise the larvae, and *Stomatoceros sulcatiscutellum*, Gir., and *Xanthopimpla punctata*, F., which parasitise the pupae, as well as predacious insects and the mite, *Pediculoides ventricosus*, Newp., which attacks both larvae and pupae. The parasites exert effective control of *N. serinopa* in certain parts of South India, which appears to be unimpaired by hyperparasitism by several Chalcidoids and a Eurytomid.

The parasites indigenous in Ceylon comprise *Stomatomyia bezziana*, Baranov, undetermined species of *Angitia*, *Perisierola* and *Eurytoma*, an undescribed species of *Eurytoma*, a species of *Fornicia* close to *F.*

ceylonica, Wlkn., and an undetermined Braconid, which attack the larvae, and *Brachymeria nephantidis*, Gah., which attacks the pupae. *S. bezziana* has long been a very effective parasite of *Nephantis* on the east coast of Ceylon, but its value is being reduced in some areas, since it is itself parasitised by *T. pupivora*, *Syntomosphyrum obscuriceps*, Ferrière, and an Encyrtid of the genus *Neasteropaeus*. *T. pupivora* has been recorded from *Stomatomyia* only twice, when the population of *Nephantis* was declining, but it might seriously impair the efficiency of the Tachinid if it is liberated on a large scale in infested areas and pupae of *Nephantis* are not available. The female Tachinid lays one or more eggs on a larva that is half-grown or larger. The parasite larva develops in the host and usually leaves it to pupate after about a week. If, however, the host has itself pupated, the parasite pupates within the host pupa, and the resultant adult is sometimes unable to escape. Not more than two parasites can mature in a single host. *Stomatomyia* is most numerous in the drier parts of the coconut areas and is the most conspicuous parasite in the early stages of an outbreak. *Angitia* sp. is becoming an important parasite on the east coast, and attacks larvae in the early part of their development. Only one egg is laid on each host, and the full-grown parasite larva leaves the host before spinning its cocoon ; the pupal stage lasts about 10 days. Parasitism increases with the age of the infestation.

The remaining larval parasites are of minor importance. *Perisierola* sp., which is itself parasitised by *Ceraphron* (*Calliceras*) sp., has been recorded only in the Batticaloa district. The female lays about 15–20 eggs on a half-grown larva, and the parasite larvae feed externally and usually pupate in the galleries of the host. The adults have been observed to destroy host larvae by feeding on their body fluids. The females of *Eurytoma* spp. oviposit on young host larvae, and the full-grown parasites emerge from the host to pupate in silken cocoons, usually in the groove of the mid-rib of a leaflet. *Fornicia* sp. is believed to attack the larvae of *Nephantis*, but emerges from the host pupa ; the other Braconid pupates in cocoons usually attached to the dead host larva. *Brachymeria nephantidis* is the dominant and only indigenous pupal parasite of *Nephantis* on the east coast, where the percentage parasitism by it averaged about 20 in certain localities in 1938–39, but is of little importance on the west coast, where *T. pupivora* is dominant. This Chalcid lays one, or rarely two, eggs in the host pupa, and the parasite larva feeds and pupates within the host. The pupal stage lasts about 10 days.

The author discusses the factors affecting the biological control of an insect pest by an introduced parasite, with special reference to that of *Nephantis serinopa* by *Trichospilus pupivora*, and concludes that the latter is an effective and successful parasite, on account of its relatively short life-cycle, the number and diverse age of the pupae it can attack, the large numbers developing in a single host and the absence of superparasitism. Furthermore, it is active and has greater powers of dispersion than the host, and though the optimum temperature and relative humidity for its development are 80°F. and 92–94 per cent., it can tolerate temperatures as high as 85°F. and relative humidities as low as 78 per cent. On the east coast of Ceylon, the indigenous parasites are able to control *Nephantis* adequately except when weather conditions favour its rapid increase, and it is at such times that *Trichospilus*, which is favoured by the same conditions, would be useful. The dry hot season, extending from May to November, makes it unlikely that the parasite will become permanently established, but its liberation during serious outbreaks of *Nephantis* in this region might be an effective control measure.

KANZAWA (T.). **Studies on *Drosophila suzukii* Mats.** [*In Japanese.*]—49 pp., 6 pls. Kofu, Yamanashi agric. Exp. Sta., 1939. [Recd. 1941.]

Drosophila suzukii, Mats., is widely distributed in Japan, where it infests cherries and grapes severely and also occurs in fruits of apple, peach, plum and persimmon [*cf. R.A.E.*, A **24** 315]. The percentage of cherry fruits infested ranges up to 75. In a given year there are about 13 generations, but only 3 are completed by individuals produced late in the oviposition period of successive females, owing to the length of this period. The adults, which mostly emerge at 8–9 a.m., remain motionless at 5°C. [41°F.], begin to crawl at 10°C. [50°F.], are most active about 20°C. [68°F.] and show less activity at 30°C. [86°F.]. They live for 21–66 days in May–August, but those emerging from late September onwards overwinter and sometimes survive until the following July. The eggs are laid on warm days from April to November in the fruits, ripe fruits being preferred. The number of eggs laid per cherry by a single female averaged 2·7. The oviposition period lasted 10–59 days; the average number of eggs laid per female was 384 and the number per day 7–16. The egg stage lasted 2–72 hours and was completed in about a day in cherry in May and June. The adults begin to appear in early April and are most numerous in June–July and September–October. They enter hibernation in sheltered places in late November at about 5°C.

The larvae mature in about 3–13 days and the pupal stage, which is usually passed in the fruits but sometimes in the soil, lasts 3–15 days. If the fruits are decayed or very unripe, only 50 per cent. of the larvae survive to pupate. As many as 65 adults may emerge from a single cherry. The life-cycle is completed in about 21–25 days at a constant temperature of 15°C. [59°F.] and about 9–11 at 25°C. The larvae are parasitised by a Diapriid of the genus *Phaenopria*.

TAKAHASHI (R.). **Some Coccidae from Formosa and Japan (Homoptera), V.**—*Mushi* **13** no. 1 pp. 18–28, 3 figs. Fukuoka, 1940.

This paper comprises records of eight species of Coccids from Formosa, of which three are described as new. The others include *Fiorinia proboscidaria*, Green, found on *Citrus* spp. and *Eugenia jambos*, and *Aulacaspis* (*Chionaspis*) *madiunensis*, Zehnt., on sugar-cane and grasses. *F. proboscidaria* is closely related to *F. theae*, Green, and may be only a variety of it. *A. madiunensis* is also recorded from Australia, the author having received specimens collected on sugar-cane in Queensland in September 1938 [*cf. R.A.E.*, A **28** 402].

BRAIR (J. H.). **The Control of Plum Fruit Sawfly** (*Hoplocampa flava*).—*Agric. Bull. Palestine* October–December 1940 pp. 165–166. [Jerusalem] 1940.

Hoplocampa flava, L., is an important pest of all early- and medium-flowering varieties of plum in the hilly regions of Palestine. The adults emerge when the trees are beginning to flower, and lay their eggs singly in the fully opened flowers. The larvae bore in the fruits and attack several in succession before they drop to the ground and construct cocoons in the soil in which to overwinter. Thorough spraying with quassia extract in soap solution [*cf. R.A.E.*, A **25** 465] when 90 per cent. of the petals have fallen from early- and medium-flowering varieties, or when the petals of the late varieties begin to fall, is recommended for control. The extract is prepared by soaking quassia chips in water for at least 24 hours [*cf.* **27** 297] and mixed with the soap solution on the day of application [**27** 46].

BRAIR (J. H.). **Simple and cheap Methods for controlling the Vine Bud Moth** (*Theresia ampelophaga*).—*Agric. Bull. Palestine* October–December 1940 pp. 166–167. [Jerusalem] 1940.

Theresimima (*Theresia*) *ampelophaga*, Bayle, causes severe damage to vines in the hilly parts of Palestine, particularly in spring when the overwintered larvae migrate to the swelling buds and bore into them. They thus prevent the opening of the buds from which grow the main shoots that bear the greater part of the crop. When the secondary buds burst, they feed on the growing leaves and reduce the vigour of the vines. They should be controlled by applying an adhesive band round the base of each pruned shoot during the first ten days in March, before they migrate.

SAUER (H. F. G.). **Primeiros resultados das experiencias de combate à broca do algodoeiro** *Gasterocercodes brasiliensis* **Hambl.** (**Col. Curcul.**) **por meio de pulverizações com caldas arsenicais.** [The first Results of Experiments with arsenical Sprays against *G. brasiliensis*.]—*Arq. Inst. biol.* **11** pp. 499–530, 6 pls., 1 graph, 5 refs. São Paulo, 1940. (With a Summary in English.)

An account is given of investigations in São Paulo, Brazil, on the life-history and control of *Gasterocercodes brasiliensis*, Hambl. [*cf. R.A.E.*, A **26** 502], which is an important pest of cotton and is not satisfactorily controlled by the methods hitherto recommended [**26** 504]. Observations have shown that at the time of picking almost all the cotton plants are infested by this weevil. Large numbers of the adults survive the winter in spite of cultural measures and are attracted in spring to the new cotton fields. Those planted early are attacked first, and as their area is comparatively small, the infestation is heavy and the young plants are severely injured or even destroyed. One early-planted field had an infestation of 95 per cent. 3 months after planting, and about 50 per cent. of the plants were killed. The spread of infestation is difficult to explain on the assumption that the adults migrate by crawling. They are active only at night, which renders observation difficult, but the author has shown that they are able to fly. At first the overwintered adults feed on any part of the young plant, but in older ones, the region of the root collar is preferred for feeding and oviposition. Oviposition begins when the plants are about 3–4 ins. high. During the preoviposition period of about 5 days, the adults feed on the leaves and bark, with a marked preference for the lower part of the stem. From October to March, when temperature and humidity are highest, development from egg to adult emergence from the stalks takes about 72 days, the first generation requiring less than the second.

In view of work by Pyenson [**27** 137], experiments were carried out on the value of arsenical sprays against the adults, and the results are given in detail in a series of tables. The insecticides tested in the laboratory were arsenates of calcium, lead and aluminium containing 40·18, 32·2 and 27·6 per cent. As_2O_5, respectively. They all reduced the amount of feeding on sprayed plants and gave considerable mortality. They were effective in the order given, but aluminium arsenate was much inferior to the others. The females appeared to feed more than the males, but mortality was about equal. A spray of 0·5 per cent. calcium arsenate gave very good results, and these were not improved by increasing the concentration. It was therefore adopted in preliminary field tests on artificially infested plants. The percentage mortalities 5 and 10 days after treatment were 91·7 and 98, respectively, and very similar results were obtained in a second test.

In further experiments, in which field plots arranged in a latin square were artificially infested with weevils, sprays of 0·3 per cent. calcium arsenate, 0·3 per cent. lead arsenate and 0·25 per cent. Paris green were applied 8 times at weekly intervals, begining on 2nd December. The results are recorded in tables, giving the proportions of plants infested on various dates and the numbers of all stages of the weevil found on them, and are analysed statistically. They showed that calcium arsenate and lead arsenate were significantly superior to the controls, and calcium arsenate to Paris green, but the differences between the two arsenates were not significant. Paris green was barely superior to the controls. The differences in effectiveness were to some extent obscured by faulty application in the early part of the experiment and by migration of weevils from the controls to the sprayed plots.

In an area of about 21,000 sq. yds. sprayed four times at intervals of 25–30 days with 0·6 per cent. calcium arsenate, starting when the plants were 5–6 ins. high, the infestation was 32 per cent. after four months, as compared with about 74 per cent. in a neighbouring unsprayed field. After this date, the infestation increased and at harvest was about equal in the two areas. The population in the sprayed field, however, consisted chiefly of young individuals, and there was little deformation of the stalks. The growth of the plants was far better, and there seemed to be less shedding in the treated area. The correct dates for spraying have not been determined, but the applications should begin when the plants are only a few inches high; the first spray should cover the entire plant, but the others only the lower part.

de Toledo (A. A.). **Notas sobre a biologia do** *Chrysomphalus aonidum* **(L., 1758) (Homoptera) no estado de S. Paulo, Brasil.** [Notes on the Biology of *C. ficus* Ashm., in São Paulo.]—*Arq. Inst. biol.* **11** pp. 559–578, 2 pls., 5 refs. São Paulo, 1940. (With a Summary in English.)

The observations here recorded on *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) were made in 1937–39 in the district of Campinas (São Paulo), where this Coccid sometimes causes young *Citrus* trees to lose their leaves and suffer visible retardation of growth. It is less common on older, fruit-bearing trees and much less injurious than in some other parts of the world.

The average longevity of the females from the period of settling ranged from 83 days at 24°C. [75·2°F.] to 204 at 19·2°C. [66·56°F.]. Unfertilised females lived for up to 9 months, but did not oviposit. The sexes are generally equal in numbers, and one male is capable of fertilising up to 12 females. Pairing occurred soon after the females had moulted for the second time and oviposition began 23–70 days later. The oviposition period lasted 28–107 days. The largest number of eggs laid by an individual female was 285. The egg stage lasted 1–24 hours, and 9 generations were observed from March 1937 to March 1939. There was considerable mortality in all developmental stages and at all seasons of the year, but it was more pronounced from December to March. Observations in 1938–39 showed that this was not due to exposure to sunshine or shade, and not solely to parasitism, which begins in December, reaches its peak in March, when the percentage parasitism of males and females totalled 85 and almost 60, respectively, in 1938, and ceases in June. The parasites bred were the Aphelinids, *Marietta* sp., *Aphytis* sp., *Aspidiotiphagus lounsburyi*, Berl. & Paoli, *A. citrinus*, Craw, *Thysanus fax*, Gir., and *T. townsendi*, Ashm. The Coccid was also destroyed by predators, including the Coccinellids, *Pentilia egena*, Muls., and *Azya luteipes*, Muls., which are active throughout the year.

CHAMBERLIN (W. J.). **Entomological Nomenclature and Literature.**—Cr. 4to ix+103 pp., frontis., multigraphed, many refs. Ann Arbor, Mich., Edwards Bros., Inc., 1941. Price, cloth $2·60 ; press board $2·00.

The purpose of this book is to provide a text-book of zoological nomenclature and to facilitate the location in the extensive literature of information relating to any branch of entomology. It is intended for students, and series of questions are appended to each section so that the extent to which they have grasped its essential contents may be ascertained. In the first part (pp. 1–44), the importance, development and historical background of nomenclature are described, and the articles laid down by the International Commission on Zoological Nomenclature are quoted and discussed, together with supplementary notes on family names, *nomina conservanda* and the terms used in designating type specimens.

The second part (pp. 44–103) comprises an annotated list of publications classified as : bibliographical works ; indices and guides to popular scientific literature ; publications issued by official organisations in the United States of America ; serial publications from various countries ; general works on entomology ; catalogues, monographs, etc., on single orders and lesser groups ; useful references to special subjects ; and works not exclusively entomological but of value to entomologists. This list is preceded by notes on reviewing literature and assembling a bibliography.

DAVIAULT (L.). **Notes sur l'action des parasites de la chenille à tente du cerisier:** *Cacoecia cerasivorana* **Fitch.**—*Nat. canad.* **66** no. 6–7 pp. 179–187, 2 graphs, 9 refs. Quebec, 1939. [Recd. 1941.]

Lists are given of the parasites of the cherry tent caterpillar, *Tortrix* (*Cacoecia*) *cerasivorana*, Fitch, recorded in the literature [*cf. R.A.E.*, A **6** 507 ; **25** 251] and of those bred in Quebec during an outbreak of this Tortricid in 1937. The latter comprised the Tachinids, *Phytomyptera leucoptera*, Johnson, and *Zenillia blanda*, O.-S., the Braconids, *Macrocentrus cerasivorana*, Vier., and *Microdus* (*Bassus*) *agilis*, Cress., and the Ichneumonids, *Pimpla* (*Ephialtes*) *conquisitor*, Say, and *Labrorychus* sp. The Pteromalid, *Habrocytus phycidis*, Ashm., was reared in small numbers from cocoons of *Macrocentrus cerasivorana*. Observations on 35 nests of the Tortricid showed that parasites formed 31·1 per cent. of the adults that emerged. The Tachinids were considerably more numerous than the Hymenoptera, but *Labrorychus* sp. comprised almost 21 per cent. of the parasites reared.

MAHEUX (G.). **Le liparis du saule** (*Stilpnotia salicis* **L.**) **dans Québec.**—*Nat. canad.* **67** no. 2–3 pp. 73–78, 13 refs. Quebec, 1940.

Stilpnotia salicis, L., was first observed in the Province of Quebec in the summer of 1937, when it defoliated poplars and willows on the Iles de la Madeleine, but it is considered to have been introduced there at least two years previously. In 1938, it spread to the mainland and was taken in several localities round the city of Quebec. It is feared that it may become a pest of major importance unless effective steps are taken to control it. The adults and larva are briefly described.

LAMBERT (R.). **Les autographes de l'épinette en Québec.**—*Nat. canad.* **68** no. 1 pp. 26–29. Quebec, 1941.

The Noctuids, *Autographa alias*, Ottolengui, *A. selecta*, Wlk., and *A. rectangula*, Kby., are common on spruce [*Picea*] and also attack fir [*Abies*] in Quebec. They have one generation a year, and hibernate in the egg and larval stages. Pupation takes place in mid-June, and the adults emerge about 18 days later. Characters are given distinguishing the larvae and adults of the three species. They are usually kept in check by parasites, of which the most important is a species of *Copidosoma*. This Encyrtid is apparently polyembryonic; over 800 adults have been reared from a single host larva. The total percentage parasitism of the three species was 11 in 1939 and 9 in 1940, that by *Copidosoma* being 5 and 2, respectively.

DAVIAULT (L.). **La chrysomèle du saule** *Calligrapha multipunctata* **var.** *bigsbyana* **Kby.**—*Nat. canad.* **68** nos. 3–4 pp. 57–81, 89–112, 1 pl., 7 figs., 13 refs. Quebec, 1941.

The author describes all stages of *Calligrapha multipunctata bigsbyana*, Kby., and gives a detailed account of field and laboratory observations on its bionomics carried out in Quebec in 1935–37. This Chrysomelid develops exclusively on willow, with a pronounced preference for *Salix bebbiana*, but the adults occur on poplar, aspen and many other plants. The damage caused is seldom serious, but in 1934 and 1935 considerable injury was done to ornamental willows and in forest nurseries. The complete life-cycle lasts one year; the adults emerge at the end of summer and feed on the foliage until the autumn frosts, when they go into hibernation under débris on the ground. During hibernation, 48 per cent. of the males and 38–41 per cent. of the females died. The adults survived normally for a year, but occasionally overwintered twice. Oviposition began in May and continued until the summer was well advanced, the eggs being laid on the lower surfaces of the leaves. Individual females laid up to 300 eggs. The durations of the egg stage, larval stage on the leaves and prepupal and pupal stages in the soil averaged 7·5, 21, 6·3 and 7·6 days, respectively, but varied with temperature. Considerable numbers of the eggs and young larvae are destroyed by the larvae and adults. The eggs are parasitised by the Miscogasterid, *Erixestus winnemana*, Crwf., the larvae by a Braconid of the genus *Meteorus*, and the adults by the Tachinid, *Doryphorophaga dorsalis*, Coq., but the most important factor in natural control of the Chrysomelid is the weather. In 1936, the population was considerably reduced by exceptionally cold and rainy periods.

PECHUMAN (L. L.). **Notes on the Feeding and Breeding Habits of** *Saperda tridentata* **Oliv.**—*Bull. Brooklyn ent. Soc.* **35** no. 4 pp. 113–116. Lancaster, Pa., 1940.

An account is given of the results of observations on the bionomics of the Lamiid, *Eutetrapha* (*Saperda*) *tridentata*, Ol., on elm in south-eastern New York [*cf. R.A.E.*, A **28** 479]. The emergence of the adults continues from early May to mid-July, with a peak in the last week of May and the first week in June. The sexes occur in about equal numbers, but the males emerge earlier than the females. The beetles are active at night, when they are attracted to light, and shelter on bark or among the foliage by day. They feed on leaves, petioles and twigs for the first three or four days, and the females then start to oviposit. The larger veins of leaves and considerable areas of the surrounding tissue are destroyed, but only the outer layer of tissue of twigs and petioles is eaten, although sometimes twigs are partly or completely severed. Laboratory experiments in 1937 and 1938 showed that feeding is necessary before oviposition can take place.

The eggs are deposited singly in slits made in crevices in the bark ; most females lived for about a month under field conditions and laid 50–60 eggs during that time. Fresh sappy wood is generally selected for oviposition, and newly-cut logs and weakened trees are particularly susceptible. Trees suffering from food or water deficiency or root injury but showing no external symptoms are frequently attacked, but the author believes it probable that absolutely healthy trees never are ; leaking gas mains near a tree may reduce its vitality sufficiently to render it susceptible. The first sign of infestation in apparently healthy trees is the thinning and dropping of the foliage, followed by the dying off of a branch or two. Larvae in a weakened tree or an isolated injured branch may migrate to the healthy part of the tree, and in such a case the upper branches are usually killed first. If a tree begins to die from some other cause, all parts of it are infested simultaneously. In fresh, moist wood, the larval tunnels may be restricted almost entirely to the inner bark and do not penetrate below the surface of the sapwood except during the construction of the pupal cells, which are usually made 5–6 mm. below its surface and plugged with frass. The cells are sometimes situated between the bark and wood, or in thick bark, and a hole is occasionally gnawed above the entrance for adult emergence. The construction of the cells begins between early August and mid-October, and pupae are first present in late April and early May. The duration of the pupal period averages 24–27 days when the adults appear in May and 15–18 when they appear in June. The adults may remain in the cells for as long as a week before emerging through the larval tunnel or gnawing their way out. In sawed wood, the adult often emerges through the end of the log if the pupal cell is within ½–¾ in. of the end. Emergence is probably partly influenced by the outside temperature and the adult follows the shortest route to the surface.

The duration of the development period is very variable, even among individuals from a single batch of eggs. The normal period is a year, but it is longer in wood that has dried out rapidly ; it is never less than one year or more than three, although individuals of the Cerambycids, *Neoclytus acuminatus*, F., and *Xylotrechus colonus*, F., which are often associated with *E. tridentata*, sometimes complete their development in 3–4 months. Larvae that hatch from eggs laid in July and August usually require two seasons to develop, although some may become adult at the usual time in the following spring. The author considers that larvae of three different sizes occurring together in one place do not represent three different generations ; larvae from the same group of eggs may vary considerably in size, and it is unlikely that one portion of a tree would be attacked in two or three successive years, since fresh material is preferred and most of the available food would be consumed by the larvae of the first generation.

KLOTS (A. B.). **Two European Tortricidae (Lepidoptera) not hitherto recorded from North America.**—*Bull. Brooklyn ent. Soc.* **36** no. 3 pp. 126–127. Lancaster, Pa., 1941.

Adults of two common European Tortricids, not previously recorded from North America, were taken on Long Island, New York, on 1st July 1939. They are *Tortrix* (*Argyrotoxa*) *forskaleana*, L., which is known to have been present on Long Island since 1934, and *T. unifasciana*, Dup. Characters distinguishing them from closely related North American species are given. In Britain, the larvae of *T. forskaleana* have been recorded on maple, and those of *T. unifasciana* on privet (*Ligustrum*) ; adults of the latter were seen in very large numbers on a privet hedge on Long Island.

HAMLIN (J. C.). **Special Report of North American Infestation of** *Hypera brunneipennis* **on Yuma Reclamation Project, Arizona and California.**—*Spec. Publ. Calif. Dep. Agric.* no. 174 pp. 22–32. Sacramento, Calif., 1940.

LAUDERDALE (J. L. E.). **Some Observations on Habits and Characteristics of** *Hypera brunneipennis* **in Yuma County, Arizona.**—*Op. cit.* pp. 89–91.

In the first of these papers, both of which deal with investigations on *Hypera brunneipennis*, Boh., near Yuma, Arizona, at the time of its discovery there in April 1939 [*R.A.E.*, A **28** 120, 187], an account is given of a preliminary survey made between 27th and 30th April. Most of the weevils were in the adult stage ; pupae were fairly numerous, but larvae were scarce. Attempts to determine the limits of the infestation were hindered because the adults remain near the ground during the day and could not be captured by sweeping. The infested area extended into California, but is separated from an extensive lucerne-producing district of that State by about 35 miles of barren sandhills. The centre of the infestation appeared to be the Valley Experimental Farm of the University of Arizona, where the weevils were abundant and occurred in a number of situations, including a lucerne plot bordered by Bermuda grass [*Cynodon dactylon*] intermixed with sour clover (*Melilotus indica*) [*cf.* **28** 187], a lawn in which sour clover was growing in large quantities, and a large pecan grove with undergrowth including grass and sour clover. Adults were abundant on pecan under curled bark as high as 7 ft. above the ground. The author considers that the comparative abundance of *H. brunneipennis* on sour clover may be due to the uninterrupted development possible on it as compared with lucerne, which is harvested every month in this district. It may also be a seasonal phenomenon, since sour clover is available from autumn until the spring, in which case lucerne might be an important food-plant between April and November, provided that *H. brunneipennis* has more than one generation a year.

In the course of a discussion following the paper, in which the risk of distributing the weevil in hay, etc., from the infested area was considered, it was stated that offshoots of date palm were freed from infestation by fumigation with chloropicrin at the rate of 1½ lb. per 1,000 cu. ft. for 36 hours, but the effect of this heavy dosage on the offshoots is not known. It was suggested that *H. brunneipennis* may have been introduced many years previously with date palm offshoots imported from North Africa, Egypt or the Persian Gulf. It was considered unlikely that grain from fields in which clover also grows would be infested because the stalks are cut at a height of more than 10 ins. from the ground and the weevils are on or near the ground during the day.

Much of the information in the second paper, which deals with the period from 13th April until 18th May, is similar to that in the first. At the beginning of the period of survey, larvae in the third and fourth instars, pupae and adults were all present. Many of the pupae were at the tops of the plants. Infestations were found over an area of 8–10 square miles; they were light near Winterhaven, California. On 30th April, the adult population averaged about 13 per sq. ft. in the lawn at the Valley Experimental Farm and about 72 in the pecan grove; at this time, the weevils were feeding heavily at night. By 9th May, the population in the pecan grove had fallen to 23·75 per sq. ft., and was only 0·75 in a lucerne field. On 5th May, weevils were numerous in débris round fields and under the bark of trees; they were aestivating at this date, and were still sexually immature when dissections were made about ten days later.

Mackie (D. B.). **The Olive Scale** (*Parlatoria oleae*) **in California.**—*Spec. Publ. Calif. Dep. Agric.* no. 174 pp. 102–105. Sacramento, Calif., 1940.

Parlatoria oleae, Colv., was first observed in California in 1934 [*R.A.E.*, A **23** 527], but may have been introduced on olive cuttings from Greece or Italy considerably earlier. Its distribution throughout the world is briefly summarised; in the United States, it also occurs in Maryland, where it has caused severe local injury to privet [*Ligustrum*], and Arizona, where it has been found on 41 different plants. Its status in California in 1935 and 1938, when surveys were made, is described [**24** 662; **28** 63]. Characters are given for its identification in the field and for separating it from *Aspidiotus rapax*, Comst. (*camelliae*, auct.) and *A. hederae*, Vall., with which it is often associated; it is sometimes associated on certain food-plants with *A. perniciosus*, Comst.

In California, nearly all the examples found in December and January are adults; no eggs were observed during these months, but the presence of the remains of numerous dead adults and empty shells of males indicated that the females had been fertilised. In Arizona, eggs are present in every month except December and January, and there are two hatching periods, in mid-April and late July. The branches of infested trees have a grey scurfy appearance, and the leaves of some species are mottled. Infested fruits are pitted where infestation is light, or wrinkled where it is heavier. Olives become discoloured and malformed; immature plums are pitted and wrinkled but not discoloured. The measures adopted in an attempt in progress to eradicate *P. oleae* from California are very briefly reviewed; control by chemical means is difficult [**28** 63], and the economic practicability of any artificial means of control is limited.

Solving Utah Canning Crop Problems. Proceedings of the Fifth Annual School for Canning Crop Growers and Canners Fieldmen, Ogden, Utah, 1941.—[*Publ.*] *Utah agric. Coll. Ext. Serv.* N.S. 109, 31 pp., 4 figs. Logan, Utah, 1941.

This publication includes summaries of the following papers on insect pests in Utah:—

Gimlin (F.). **Pea Weevil in Utah** (p. 3). Infestations of peas by the pea Bruchid [*Bruchus pisorum*, L.] vary in severity from year to year. The adults hibernate [*cf. R.A.E.*, A **20** 24] and become active in spring when the temperature reaches 70°F. Eggs are deposited on the pods. The migratory habits of the Bruchid render necessary the frequent sweeping of fields in order to determine its presence.

Brindley (T. A.). **Habits of the Pea Weevil** (pp. 3–6). **Pea Weevil Control** (pp. 6–12). The information in the first paper on the bionomics and sources of infestation of *B. pisorum* on peas is very similar to that already noticed [**26** 653, 654]. Satisfactory control is afforded by dusts of derris, cubé or timbo mixed with talc or diatomaceous earth to contain 1 per cent. rotenone and applied at the rate of 20 lb. per acre. As many as three applications may be necessary [*cf.* **27** 325; **29** 408]. Various types of dusting apparatus are described and illustrated. Other control measures include clean cultivation, the planting of uninfested seed and fumigation of the harvested crop.

Moss (F.). **Pea Weevil in the Payette Valley** (pp. 12–14). The author briefly describes the precautions that are taken in one district in Utah to prevent the infestation by *B. pisorum* of peas intended for canning. They include careful examination of fields by sweeping, dusting with 4 per cent. rotenone in talc and the removal of chance infested plants just before harvest. Infested patches are ploughed under or fed to stock.

Knowlton (G. F.). **Development of Pea Weevil Problem** (pp. 14–15). Infestation of peas by *B. pisorum* in Utah is somewhat sporadic. Serious injury was caused in 1899 and again in 1918–20, but reports of damage to peas for canning were not received until recently. Observations showed that the Bruchid was more numerous in 1937 than in 1936. There were further increases in 1938, when injury was reported from several localities, 1939, when about 100 acres of peas were not harvested in the most severely infested area, and 1940, when infestation developed rapidly. The numbers of Bruchids entering hibernation in 1940 were the greatest ever observed in the State, and preparations were made for a vigorous control programme in 1941. The measures recommended are briefly discussed [*cf.* preceding sections], and it is emphasised that control of the Bruchid in gardens is essential, as these provide a ready source of infestation.

KNOWLTON (G. F.). **Pea Aphid Control in Utah** (pp. 17–18). Experiments in Utah [*cf.* **27** 29] and other States have shown that with adequate equipment and proper insecticides the pea Aphid [*Macrosiphum onobrychis*, Boy.] can be controlled and serious commercial losses prevented. Derris or cubé dusts with a content of not less than 1 per cent. rotenone applied at the rate of 35–40 lb. per acre are recommended, and early application, repeated later if necessary, ensure increased yield in seasons when the Aphid is injuriously abundant. Treatment with a nicotine vaporiser [*cf. loc. cit.*] is also effective.

DORST (H. E.). **Tomato Fruitworm Control in Utah** (pp. 23–24). In experiments on the control of *Heliothis armigera*, Hb., on tomato in Utah in 1940, when infestation was more severe than in 1939, a dust of natural cryolite and maize flour gave 51–73·9 per cent. control. Natural cryolite mixed with talc or tobacco dust gave similar results, while undiluted calcium arsenate and a bait of natural cryolite and maize meal were less effective. The best results were given by three applications of the dust, in late July, mid-August and early September, at rates of 20, 25, and 25 lb. [per acre], respectively. Complete coverage of the young leaves is essential in order to kill the larvae before they reach the fruits.

DORST (H. E.). **Reducing Curly-top Disease Losses** (pp. 25–26). Two distinct movements into the tomato-growing districts of northern Utah of the Jassid, *Eutettix tenellus*, Baker, which transmits the virus of curly top, occurred during the spring of 1940. The first of these, involving large numbers of leafhoppers originating in southern Utah and northern Arizona, occurred during late April and early May. They transmitted the virus to sugar-beet and also to early-planted tomatos, killing approximately 10 per cent. of the latter. The second movement, consisting of migrations of leafhoppers from neighbouring breeding areas in northern Utah, took place from about 20th May to 15th June. The Jassids involved in it transmitted the virus to mid-season and late tomatos, causing approximately 75 per cent. of the total seasonal loss of plants. Symptoms of the disease in the early plantings became evident about 3 weeks after the first batch of leafhoppers entered the fields, while the peak of the loss from the second movement occurred approximately 30–35 days after the arrival of the first individuals. About 35 per cent. of the exposed tomato plants under observation were killed by the disease in 1940, as compared with only about 2 per cent. in 1939. Experiments in 1939–40 showed that the plants could be protected from infestation by *E. tenellus* by means of cheese-cloth covers, which, however, are expensive. The numbers of plants infected with the disease were reduced by 55–85 per cent. by covering them from the time of planting until mid-June. Substantial reductions of mortality were also obtained by a system of double-hill planting, in which a plant is set at each of two corners of the hole when the soil is broken by the shovel, the two plants being about 6 ins. apart. In an area of heavy infestation in 1940, the average percentages of plants that survived at the end of the season ranged from 76·0 to 87·7 in double-hill plots, as compared with 24·9–29·2 in plots having one plant per hill, and the increased yield offset the cost of the extra plants required even in 1939.

Dean (G. A.). **Report of the State Entomologist. Some Insects causing Injury to Shade Trees in 1939.**—*Bienn. Rep. Kans. hort. Soc.* **45** pp. 169–172. Topeka, 1940.

Insects injuring shade trees in Kansas in 1939 included *Cryptaspidiotus shastae*, Coleman, which was a serious pest of red cedar [*Juniperus virginiana*] in several localities in the centre and north-east of the State during the five years, 1935–39, when the summers were hot and dry, *Fascista* (*Gelechia*) *cercerisella*, Chamb., which caused severe damage to redbud [*Cercis canadensis*] during the same period, and *Melasoma lineatopunctata*, Forst. (*Lina scripta*, F.), the larvae and adults of which partly or completely defoliated willows and poplars throughout the north-east of the State during June. There are at least two, and probably three, generations of *C. shastae* in the year. The females pass the winter three-quarters grown, mature in the middle of May and produce young 8–9 days later; the first crawlers were observed during the last week of May. Females of the summer generations produce young when they are 51–97 days old; 40 females produced an average of 12 each in breeding experiments. Three sprays of 1 pint nicotine sulphate, 2 quarts winter or summer spray oil and 100 gals. water, applied about 31st May, 1st July and 14th August, gave excellent control of *C. shastae* and did not injure the trees. Where the infestation was severe, a fourth spray was applied in mid-September. *F. cercerisella* has two or three generations a year and overwinters in the pupal stage [*cf. R.A.E.*, A **25** 773]. The adults emerge in April, and the female lays one or two eggs on each of many of the leaves. The larva folds the leaf and feeds within the folded portion. Sprays of 3 lb. lead arsenate and 2 U.S. quarts summer oil in 100 U.S. gals. water, applied in April and May, protected the trees satisfactorily. A spray of 4 lb. lead arsenate and 2 U.S. quarts summer oil per 100 U.S. gals. gave good control of *M. lineatopunctata*, the adults of which migrated in swarms from defoliated trees to uninfested ones.

The author points out that, owing to lack of adequate funds, important work on injurious insects has been seriously neglected in the State. This includes making surveys both to determine the distributions of pests that are known to occur there, such as *Cydia* (*Laspeyresia*) *molesta*, Busck, and to discover whether pests that do serious damage in other States, notably *Hypera variabilis*, Hbst. (*postica*, Gylh.) and *Pantomorus leucoloma*, Boh., have become established.

Parker (R. L.) & Lamerson (P. G.). **Lead Arsenate Combinations and Basic Copper Arsenate as Control Measures for the Codling Moth during the Season of 1939.**—*Bienn. Rep. Kans. hort. Soc.* **45** pp. 173–179. Topeka, 1940.

An account is given of experiments on the control of the codling moth [*Cydia pomonella*, L.] on apple in north-eastern Kansas in 1939.

All the trees received a calyx spray and eight cover sprays containing 4 lb. lead arsenate or basic copper arsenate per 100 U.S. gals. spray ; either ¼ lb. soybean flour or 1 U.S. quart Orthol K oil with or without ¼ lb. zinc sulphate was added to the second, third, fourth and fifth cover sprays on some of the lead arsenate plots. Lead arsenate with only ¼ lb. soybean flour was not observed to damage the foliage [*cf.* *R.A.E.*, A **28** 477], and was the most effective of the sprays tested (91 per cent. uninjured fruit at harvest), followed by lead arsenate alone or with zinc sulphate and oil (89 per cent. uninjured fruit). The effectiveness of lead arsenate alone, under drought conditions, confirmed the results obtained in previous years. Basic copper arsenate (67 per cent. uninjured fruit) appeared to afford good control of the first generation, but was ineffective against the second and third, and appeared to give progressively poorer control as the season advanced. It was found that a cover spray in late August or early September, against the third generation, was necessary for the production of undamaged fruit, and that commercial washing must be carried out carefully to bring the sprayed fruit below the tolerance for arsenic.

PARKER (R. L.) & LAMERSON (P. G.). **Control of the American Strawberry Leafroller during the Season of 1939.**—*Bienn. Rep. Kans. hort. Soc.* **45** pp. 181–186. Topeka, 1940.

Investigations on the seasonal development and control of *Ancylis comptana*, Froel. (*fragariae*, Walsh & Riley) on strawberry in Kansas were continued in 1939 [*cf.* *R.A.E.*, A **28** 477]. Effective control of the first generation was obtained with three sprays of nicotine sulphate and summer oil (1 : 2 : 800) applied at 5–day intervals, beginning when the first larvae were observed (90 per cent. control), or with three applications of 15 or 20 per cent. Pyrocide dust (0·3 or 0·4 per cent. pyrethrins) or a 25 per cent. pyrethrum dust (0·5 per cent. pyrethrins), made at the same intervals, but beginning five days later (91, 94 and 92 per cent. control). The addition of 3 lb. lead arsenate per 100 U.S. gals. to the first nicotine spray increased the control to 95 per cent. Lead arsenate could not be added to later sprays for fear of leaving poisonous residues on the fruit. Pyrethrum emulsion sprays appeared to be less effective, a proprietary nicotine oil emulsion scorched the foliage severely, and summer oil at concentrations higher than 0·25 per cent. appeared to stunt it slightly.

Sprays of 4 lb. Kalo [natural cryolite] or 3 lb. lead arsenate, both with 1 U.S. quart summer oil per 100 U.S. gals. water, applied three times at intervals of 10 days beginning when the first larvae were observed, were almost equally effective against both the second generation (73 and 74 per cent. control) and the third (78 and 81 per cent.).

BAKER (H.). **Codling Moth Studies in northeastern Kansas and northwestern Missouri during 1939.**—*Bienn. Rep. Kans. hort. Soc.* **45** pp. 187–196. Topeka, 1940.

An account is given of field tests in Kansas in 1939 with sprays containing lead arsenate or nicotine-bentonite against the codling moth [*Cydia pomonella*, L.] on apple. The quantities of spray materials given are those used per 100 U.S. gals. All the trees received a prebloom scab spray of liquid lime-sulphur, a calyx spray containing 3 lb. lead arsenate, 3 lb. hydrated lime and 6¼ lb. dry lime-sulphur, and seven cover sprays.

The control given by the standard lead-arsenate schedule, in which the first and fourth cover sprays contained 3 lb. each of lead arsenate and hydrated lime, the second and third 4 lb. of each, and the remainder 3 lb. lead arsenate and Bordeaux mixture (¾ : 1½), was not significantly improved by the addition of 3 U.S. quarts mineral oil to the third spray or of 8 lb. brown sugar [*cf. R.A.E.*, A **29** 129] to all but the first, but was considerably increased by the addition of 3 U.S. quarts mineral oil to the third and fifth sprays or of ¼ lb. soybean flour to all the sprays. There was less residue at harvest on apples treated with the standard spray than on any of the others, but all could be cleaned below the tolerance of 0·025 grains lead per lb. fruit by washing except those that received oil in the fifth cover spray. It appears that the use of lead arsenate with soybean flour throughout the season might improve control without making complicated washing necessary, but the addition of mineral oil to sprays later than those against the first generation might involve more drastic washing.

Sprays of tank-mix nicotine-bentonite, consisting of 1 U.S. pint nicotine sulphate, 5 lb. bentonite, 1 U.S. quart soybean oil and ½ oz. sodium lauryl sulphate, gave more effective control than any other schedule, but left heavy residues that required washing. Halving the amount of tank-mix nicotine-bentonite in the last three sprays resulted in a lighter residue, which was, however, too heavy to be removed by wiping in many cases, but the use for the last three sprays of 4 lb. processed nicotine bentonite (4·75 per cent. nicotine) and 2 U.S. quarts mineral oil, or ⅔ U.S. pint nicotine sulphate, 1 lb. bentonite and 2 U.S. quarts mineral oil gave light residues that were readily removed by wiping. The omission of sodium lauryl sulphate from all the sprays of a schedule made little difference in the control obtained. The modified nicotine-bentonite treatments were about equally effective, and gave control comparable with all but the most effective lead-arsenate treatments. Processed nicotine bentonite in all sprays left a light inconspicuous residue, but was ineffective against a heavy infestation at practical dosages. None of the materials tested caused noticeable injury to fruit or foliage, but the size of the fruit appeared to be inversely proportional to the efficiency of the treatments.

Two triple-acting spray programmes [*cf.* **26** 554; **28** 519], consisting of three cover sprays containing 3 lb. lead arsenate and 1 U.S. pint nicotine sulphate or free (50 per cent.) nicotine, with 3 lb. hydrated lime and either 3 lb. wettable sulphur or ¼ lb. soybean flour in the first two, and 5⅓ pints summer oil in the third, and the same schedule with only half the quantity of nicotine in each spray were compared with the same sprays without nicotine against the first generation of *C. pomonella* on apple trees that has received uniform prebloom and calyx sprays. The mineral oil could not safely be added at ovicidal strength until the third spray, owing to its incompatibility with fungicides. At the end of the period of first-generation activity, the trees sprayed with the triple-acting sprays had less infested or injured fruit than the others, but the differences were not significant, and the trees were too heavily infested to be left unsprayed against the later broods. Four cover sprays containing lead arsenate were therefore applied to the whole orchard against the second and third generations, but the fruit was heavily infested at harvest, and it is considered that further tests must be carried out with this programme before it can be recommended.

Studies begun in 1939 to find the relation between moth emergence as indicated by the number of empty pupal cases found by inspection three times a week, moth activity as indicated by the number of moths caught daily in bait traps, and moth activity as indicated by the number of eggs found at five-day intervals, showed that there was a close correlation between the time that moths emerged and the time that eggs were deposited and between the number of moths that emerged and the number of eggs that were deposited, but the correlation between the number of moths caught in bait traps and the number of eggs deposited was less close. From a practical standpoint, however, the trap catches indicated moth activity accurately enough for timing spray applications when the period needed to make the applications was not too long.

PARKER (R. L.). **Insects which attack the Redbud.**—*Bienn. Rep. Kans. hort. Soc.* **45** pp. 239–242. Topeka, 1940.

The redbud (*Cercis canadensis*) is not usually much damaged by insects, but was seriously injured in Kansas during the drought years of 1933–38 by *Fascista* (*Gelechia*) *cercerisella*, Chamb., and *Chrysobothris femorata*, Ol., all stages of which are briefly described. Notes are given on the bionomics of *F. cercerisella* [*cf. R.A.E.*, A **27** 376; **29** 632]; a fungus attacks the larvae during rainy weather. *C. femorata* infests trunks and branches exposed to the sun. The adults emerge and oviposit during May and June. The eggs are laid in crevices and under scales of bark, and the larvae bore into the sapwood, making flattened shallow tunnels, and pupate in the following April or May. Since the trees are attacked when weakened by drought, defoliation or exposure to the sun, they should be kept in vigorous condition by cultivation, fertilisation and watering and protected from defoliation. The trunks and larger branches likely to be exposed to the sun should be wrapped in paper for two years. Seriously injured trees should be burned before April to prevent the spread of the infestation.

Other insects observed on redbud are a Jassid and an Aleurodid that attack the leaves but have not been identified, and *Aphis pawneepae*, Hottes, which has caused considerable damage when infesting the roots. The overwintering eggs of this Aphid are laid on the twigs or branches in late October or early November and hatch in April or May. The Aphids breed on the lower branches or twigs until late May or early June, when they migrate to the larger roots [*cf.* **27** 376]. A spray of nicotine sulphate with soap or summer oil emulsion, applied to the lower side of the small branches, is recommended for their control.

FENTON (F. A.). **The Brown Elm Scale: Description and Control.**—*Bull. Okla. agric. Exp. Sta.* no. 245, 6 pp., 2 figs. Stillwater, Okla., 1940.

Lecanium corni, Bch., is one of the commonest Coccids on elm in Oklahoma, where it also attacks mulberry, plum, pecan and maple; a list is given of 23 other trees on which it is known to occur. On elm, injury usually becomes apparent in April and May; heavy infestations kill the smaller branches, stunt the growth of the tree and weaken it so that it becomes susceptible to attack by borers and to disease. Eggs are deposited in early summer, and on hatching, the Coccids migrate to the leaves, where they attach themselves first to the lower surfaces and later along the main veins. Before the leaves fall in autumn, they migrate to the bark of the smaller branches, where they overwinter ; feeding is resumed when the sap starts to flow in spring, and development is completed shortly afterwards.

Good control is given by applications of an oil spray in March when the trees are in flower, but the leaf buds are still dormant ; the spray kills the flowers, but does not delay the opening of the leaf buds or check the growth of the tree. In experiments, 88·2–95·2 per cent. control was given by two brands of miscible oil and one of oil emulsion ; the poor results given by two other sprays, one of which was a miscible oil and the other an oil emulsion, were possibly due to cold, windy and showery weather at the time of spraying. Summer sprays were ineffective. Care should be taken to cover all the smaller branches, especially the lower ones, but the trunk and largest branches need not be sprayed. About 5–6 U.S. gals. spray is required for a shade tree of average size in Oklahoma. The spray should not be applied when the temperature is below 40°F. or if frost is expected within 24 hours.

WEISS (F.) & BAUMHOFER (L. G.). **Culture, Diseases, and Pests of the Box Tree.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1855, 17 pp., 9 figs., 1 ref. Washington, D.C., 1940.

A section (pp. 15–17) of this bulletin contains notes on the appearance, bionomics and control of pests of cultivated box (*Buxus*), notably the tree box, *B. sempervirens* var. *arborescens*, and the dwarf box, *B. sempervirens* var. *suffruticosa*, in the middle Atlantic region of the United States. The Cecidomyiid, *Monarthropalpus buxi*, Lab., is a serious pest of tree box, but is of little importance on dwarf box. The larvae mine in the leaves for most of the year [*cf. R.A.E.*, A **25** 757], causing small oval blisters to appear on the lower surfaces in late summer, and heavy infestations result in severe injury to many of the leaves, premature shedding, and the gradual weakening of the plants. At Washington, D.C., adult emergence begins between the end of April and the middle of May. The usual method of control is to spray with 1 U.S. gal. molasses and 9 teaspoonfuls nicotine sulphate in about 5 U.S. gals. water every 3 or 4 days, or as often as is required to keep the foliage sticky, from the time the first adults appear until the end of the flight period (about 2 weeks). The sticky deposit traps and kills the adults and prevents oviposition.

Psylla buxi, L., feeds on the young leaves, causing them to curl ; the growth of the twigs is sometimes retarded as a result of heavy infestation, but injury is not generally serious. This Psyllid usually appears on the plants in spring, and can then be controlled by prompt applications of a spray containing 1½ teaspoonfuls nicotine sulphate and 1 oz. soap in 1 U.S. gal. water. If infestation is severe, a second application may be needed a week or ten days later.

Spider mites, especially *Tetranychus telarius*, L. (*bimaculatus*, Harvey), often infest box, and are most likely to become injurious during prolonged dry periods, when their feeding causes the foliage to turn yellow and weakens the plants. Control measures comprise two or more applications at intervals of 7–10 days of a sulphur dust or of sprays containing wettable sulphur, derris or nicotine. A spray of 10 oz. derris powder with a rotenone content of 4 per cent. and 1 U.S. pint sulphonated castor oil in 50 U.S. gals. water is very effective. Infestations can sometimes be checked by repeatedly spraying the foliage with a powerful stream of water, preferably during bright, dry weather.

PEIRSON (H. B.) & NASH (R. W.). **Control Work on European Spruce Sawfly in 1939.**—*Bull. Maine For. Serv.* no. 12, 19 pp., 2 fldg. maps, 2 figs. Augusta, Me., 1940.

PEIRSON (H. B.). **Control Work on European Spruce Sawfly in 1940.**—*Bienn. Rep. For. Comm. Maine* **23** repr. 10 pp., 1 map. Augusta, Me., 1941.

The first of these papers contains notes on the life-history of *Gilpinia* (*Diprion*) *polytoma*, Htg., on spruce in Maine, where it has two complete generations a year, with a partial third, on the distribution of infestations of varying intensity in the State and elsewhere in 1939 [*cf. R.A.E.*, A **29** 37, 427], and on the rearing and liberation against it of *Microplectron fuscipenne*, Zett., which was recovered in a number of districts in northern and eastern Maine, in some of which it had not been liberated until 1938. The breeding of *Microcryptus basizonus*, Grav., was continued, and this parasite and *Exenterus abruptorius*, Thnb., were liberated in a number of places. Earlier liberations included *E. marginatorius*, F., *Lophyroplectus luteator*, Thnb., and *M. basizonus* in 1935, *Microplectron fuscipenne* in 1935, 1936, 1937 and 1938, and *E. abruptorius* and *E. adspersus*, Htg., in 1937. Native parasites reared from field-collected cocoons of *G. polytoma* in 1938 were identified as *Delomerista* [*diprionis*, Cushm. (*cf.* **28** 371)] from New Hampshire or Vermont, and *Stylocryptus vulgaris*, Cress., *Spilocryptus* (*Agrothereutes*) *slossonae*, Cushm., species of *Zootrephes*, *Sagaritis* and *Polyblastus*, *Mastrus neodiprioni*, Vier., and *Pimpla* (*Ephialtes*) *pedalis*, Cress., from Maine. The last two were also reared from the cocoons of an undescribed sawfly of the genus *Neodiprion* attacking red pine [*Pinus resinosa*]. A predacious Elaterid, *Corymbites* (*Ludius*) *inflatus*, Say, was also reared from cocoons of *G. polytoma* collected at Bar Harbor.

The second paper shows the position in 1940, when the outbreak was less severe than in 1939, owing to unfavourable weather conditions, as a result of which large numbers of pupae failed to transform to adults, the destruction of the larvae by a wilt disease in some parts of the State [*cf.* **29** 422], and the attacks of parasites and predacious insects and small mammals. An improved method of breeding *Microplectron fuscipenne*, by which more than 50 million adults were reared and liberated in 394 districts, is described. Nearly 3,000 adults of *Microcryptus basizonus* were reared and liberated in three districts, together with over 1,000 received from Canada ; a parasitic mould, *Aspergillus flavus*, which developed in the host cocoons after the eggs of *M. basizonus* were transferred to them killed large numbers of parasite larvae and adults in the laboratory. Other parasites received from Canada and released were *Exenterus claripennis*, Thoms., and *E. marginatorius*. Numbers of the Pentatomid, *Podisus sereiventris*, Uhl., were observed feeding on the larvae of the sawfly.

Native parasites of *G. polytoma* reared in 1939 were *Delomerista diprionis*, Cushm., *Pimpla* (*Ephialtes*) *pedalis* and *Mastrus neodiprioni*, all from cocoons collected in southern New Hampshire and Vermont, and *M. neodiprioni* from cocoons collected in Maine. In addition, a female of *P.* (*E.*) *nuda*, Townes, was reared from a cocoon of the undescribed species of *Neodiprion* that attacks red pine and produced a single offspring when caged with larvae of *G. polytoma*.

EYER (J. R.) & ENZIE (J. V.). **Dusting and Spraying for the Control of Insect Pests of the Irish Potato.**—*Bull. N. Mex. agric. Exp. Sta.* no. 266, 40 pp., 19 figs., 9 refs. State College, N. Mex., 1939. [Recd. 1941.]

The major pests of potatoes in New Mexico, given in order of their importance, are *Paratrioza cockerelli*, Šulc, *Empoasca abrupta*, DeL., and flea-beetles (*Epitrix* spp. and *Systena taeniata*, Say), and the main part of this bulletin comprises an account of their seasonal history and feeding habits, the injury they cause and measures for their control, based on the results of several years' investigations by the State Agricultural Experiment Station. All stages of *P. cockerelli* and *Empoasca abrupta* are described. Insects that cause occasional damage and are the subject of a brief concluding section are Aphids, the Colorado beetle [*Leptinotarsa decemlineata*, Say], blister beetles, grasshoppers, cutworms, wireworms and white grubs [*Lachnosterna*]. The Aphids, of which the principal species is *Myzus persicae*, Sulz., are capable of causing severe damage, both directly and by transmitting virus diseases, but do not become abundant unless the weather is much cooler and moister than it usually is during the potato-growing season in New Mexico. Control can be obtained by the nicotine treatments recommended against *Empoasca*, and loss from virus disease is avoided by the use of certified seed potatoes.

The following is mainly the authors' summary. The nymphs of *P. cockerelli* produce the condition known as Psyllid yellows, which results in greatly reduced yields. It may be controlled by killing the nymphs with sprays of lime-sulphur or wettable sulphur, or with sulphur dusts [*cf. R.A.E.*, A **28** 221], but the timing of their application is exceedingly important. In the case of the spring-planted crop, the first application should be made shortly after the first nymphs hatch. This usually takes place before blossoming, when the plants are about six inches high. The second application should be made 10–14 days later, the shorter time interval being preferable if the Psyllids are abundant. A third application is usually necessary 10 days after the second. With late-planted potatoes, the same timing should be followed, but two sprays, a fortnight apart, will usually protect the plants until maturity. The sprays should contain lime-sulphur at the concentrations given previously [*loc. cit.*] or wettable sulphur at the rate of 6 lb. to 100 U.S. gals. water. Bentonite clay or wettable sulphur added to the lime-sulphur sprays at the rate of 1–2 lb. per 100 U.S. gals. forms an excellent spreader and adhesive. Several types of spray machinery are described. Only those developing sufficient nozzle pressure to coat thoroughly both upper and lower leaf surfaces are recommended. Sulphur dusts should be applied at the rate of not less than 25 lb. to the acre, using machines that develop a forcible continuous stream of dust. Nitrogen and phosphate fertilisers to encourage vigorous growth are useful adjuncts to the insecticides.

The nymphs and adults of *E. abrupta* produce stippling and hopperburn. When abundant these cause early death of the plant, and tuber production is curtailed. The adults cannot be successfully controlled, but large percentages of the nymphs are killed by nicotine sulphate. For spraying, it is used at a concentration of 1 : 800 and can be added to the sulphur sprays applied for Psyllid control or diluted with water, to which soap or bentonite clay (2 lb. per 100 U.S. gals.) should be added as a spreader. A dust of nicotine sulphate and lime will destroy the leafhopper nymphs effectively, and one of nicotine sulphate and sulphur will also control the Psyllid ; the formulae recommended are 85 lb. dusting sulphur or hydrated lime, 10 lb. dry lime-sulphur, 10 lb. pulverised quick-lime or 1½ lb. concentrated lye, and 10 lb. Black Leaf 40. The applications should be made at times when young nymphs are most numerous. Nicotine is recommended for use in the second and third Psyllid applications for spring plantings, and in the first and second applications for the summer-planted crop. If Psyllids are not present, watch should be kept for an increase in the number of leafhopper nymphs on the older foliage. When several are present on each leaf, it is advisable to spray or dust.

The adults of the flea-beetles perforate the leaves, and the larvae destroy the small roots and make tunnels in the skin of the tubers, thus lowering their quality. No satisfactory method has been developed for killing the larvae, but the adults can be poisoned by spraying with zinc arsenite (2 lb. in U.S. 100 gals. water) or by dusting with calcium arsenate. Where a Psyllid-control programme is necessary, these arsenicals can be combined with sulphur sprays or dusts. They are also effective against *L. decemlineata* and blister beetles.

Forty-ninth Annual Report for the Fiscal Year ended June 30, 1939.—*Bull. Wash. agric. Exp. Sta.* no. 384, 101 pp. Pullman, Wash., 1939. [Recd. 1941.]

In the report of the Division of Entomology (pp. 33–36), an account is given of investigations in Washington State in the year ending November 1939. A spray containing 5 lb. bentonite, 1 U.S. pint nicotine [? sulphate] and 1 U.S. quart herring oil [per 100 U.S. gals.] gave satisfactory control of the codling moth [*Cydia pomonella*, L.] on apple, but the fruit required washing to remove the residue [*cf. R.A.E.*, A **27** 525]. The deposits left by this spray at half the concentration and by one containing 4 lb. of a proprietary fixed nicotine (Black Leaf 155) in 100 U.S. gals. water could be removed by brushing, but the treatments were ineffective. Only small numbers of *Tetranychus pacificus*, McG., were present in the orchards in spring, but the populations increased considerably about the middle of August and very severe damage was caused in some orchards. An average of 1,165 mites and 1,590 eggs per leaf occurred on one apple tree. The most effective summer spray was Selocide, but it was feared that the selenium might be injurious to the trees [*cf.* **29** 559]. Rotenone compounds and various combinations of sulphur were somewhat less effective, but give satisfactory control when applied before infestation becomes severe. Observations showed that the cherry fruit-worm [*Cydia packardi*, Zell.] has only one generation a year in western Washington and overwinters in the stubs of sour cherry twigs.

Populations of *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) reached alarming proportions on early peas in one district, although they were smaller than in previous years on lucerne grown in the neighbourhood for hay or erosion control. The increase was due to the immigration of Aphids, mostly from heavily infested lucerne grown for hay 15–20 miles away [*cf.* **28** 621]. Later in the season, the populations on peas decreased, possibly as a result of the widespread use of rotenone against the pea Bruchid [*Bruchus pisorum*, L.].

The best control of larvae of *Helothis armigera*, Hb., on tomato was given by dusts of natural or synthetic cryolite with equal parts of diatomaceous earth, walnut-shell flour or hydrated lime ; calcium arsenate, alone or with equal quantities of hydrated lime or sulphur, was almost as effective, but dusts in which the proportion of carrier was increased were less so. The control given by two applications at an interval of two or three weeks was comparable with that from three applications at intervals of about ten days. Mineral oils of varying viscosities and unsulphonatable residues were unsatisfactory for treating the ears of sweet maize against *H. armigera* [*cf.* **28** 520, etc.] ; some oil injury developed owing to difficulty in estimating the stage of development of the ears. Clipping and removing the silks, or wrapping the ear with wire or clamping it with a small metal band, which confined the greater part of the damage to the tip of the ear, is practicable on small plantings.

The report of the Cranberry-Blueberry Laboratory (pp. 83–86), includes a brief survey of work against pests of cranberry. Liquid lime-sulphur (32°Bé.), applied on 10th March at a dilution of 1 : 10 or 1 : 15, gave excellent control of San José scale [*Aspidiotus perniciosus*, Comst.], but was less effective at a dilution of 1 : 20. A solution of 3 oz. sodium cyanide in 100 U.S. gals. water gave excellent control of larvae of *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., when enough was applied to allow it to penetrate into the sand to a depth of about 3 ins. It can be applied by means of spraying equipment or with sprinkling cans, and renders unnecessary the use of baits against the adults. A dust containing 1 per cent. rotenone gave good control of larvae of the fireworm [*Rhopobota naevana*, Hb.], but had little effect on the adults, whereas a pyrethrum dust containing 0·1 per cent. pyrethrins destroyed both stages. A proprietary spray material containing pyrethrum and rotenone was also satisfactory. Injury by fruitworms [*Mineola vaccinii*, Riley], which occur in all the cranberry-growing areas of western Washington, is most severe in late seasons. Adults have been observed in late May and early June in seasons in which growth begins early, but conditions at that time appear to be unfavourable to them, and, in addition, many are destroyed by sprays applied against *R. naevana*.

Fiftieth Annual Report for the Fiscal Year ended June 30, 1940.—*Bull. Wash. agric. Exp. Sta.* no. 394, 124 pp. Pullman, Wash. [1941].

The report of the Division of Entomology (pp. 42–47) contains an account of work in Washington State in the year ending November 1940. Of sprays tested against the codling moth [*Cydia pomonella*, L.] on apple, one consisting of 2 lb. lead arsenate and 1 lb. material containing 4 per cent. rotenone per 100 U.S. gals. was no more effective than one containing 3 lb. lead arsenate alone. When the interval between sprays containing lead arsenate and rotenone was increased, control was very poor. Xanthone was more effective than lead arsenate [*cf. R.A.E.*, A **29** 411], but in some cases caused severe injury to the fruit and foliage ; the injury appeared to result from the early applications and was not aggravated by sprays against larvae of the second generation. In preliminary investigations on the comparative value of heavy and moderate or light applications of lead-arsenate sprays, the deposits on the apple fruits from applications of 30–35 U.S. gals. of a spray of the non-building type were no lighter than those resulting from applications of 70–80 U.S. gals. Heavy applications of inverted sprays resulted in greater arsenical deposits than light ones at the beginning of the season, but the difference became progressively less in later applications and was very small after the last spray. The degree of infestation by *C. pomonella* appeared to vary more with the proximity of other infested trees than with the amount of spray applied. Real differences in control may have been obscured because the sprays were applied to single trees only. Appreciable numbers of first-generation adults of *C. pomonella* were caught in light-traps in one area of the orchard, but there was no noticeable reduction in subsequent infestation in this area.

Infestation of orchards by *Tetranychus pacificus*, McG., was less severe than in 1939. In some cases, sulphur sprays applied early in the season did not give control. Of sprays applied in summer, those containing rotenone-bearing materials were effective against the mites, but not against the eggs. Precipitated lime-sulphur and light summer oils at concentrations of 0·75–1·0 per cent. gave promising results, but other sulphur sprays and oils at concentrations of 0·5 per cent. were ineffective. Dinitro-ortho-cyclohexylphenol caused severe injury to the trees, but sodium dinitro-cresylate, which gave promising results, had no harmful effects.

Infestation by the cherry fruit-worm [*Cydia packardi*, Zell.] was reduced by sprays containing lead arsenate, calcium arsenate, derris or thiodiphenylamine (phenothiazine), but these did not control cherry fruit-flies [*Rhagoletis*], which are of greater importance, probably because of the long period during which they are ovipositing.

Damage to tomatos by larvae of *Heliothis armigera*, Hb., was most noticeable at the beginning of the picking season ; an undusted plot showed a total of 8 per cent. damaged fruits at the end of it. In experiments on control, two applications of dusts were made at an interval of a fortnight, the second two weeks before picking began. The plots received mixtures of equal quantities of natural cryolite or calcium arsenate and diatomaceous earth at the rate of 40 and 30 lb. per acre, respectively, and the percentages of damaged fruit were reduced to 3½ and 2½. Injury by the tomato hornworm [*Protoparce sexta*, Joh.] was observed on 75 of the untreated plants, 50 of those dusted with cryolite, and none of those dusted with calcium arsenate. When insecticides in combination with highly refined white mineral oils were injected into the ears of sweet maize against larvae of *H. armigera*, the percentages of uninfested and seriously damaged ears were 63 and 5, respectively, in plots treated with 5 oz. thiodiphenylamine in 1 U.S. gal. heavy oil, 77 and 6 in plots treated with 1 oz. dinitro-ortho-cyclohexylphenol in 1 U.S. gal. heavy oil, and 2 and 40 in untreated plots.

White sugar was found to be more suitable than brown for use in the tartar-emetic spray developed against *Thrips tabaci*, Lind., on greenhouse carnations [**29** 414], which is also effective against *Taeniothrips simplex*, Morison. *Thrips tabaci* is the more important species on carnations in late winter, spring and summer, and *Taeniothrips simplex* during autumn.

Observations were made on the bionomics of *Crioceris asparagi*, L., and *Agromyza simplex*, Lw., on asparagus in eastern Washington. Adults of *C. asparagi* emerged from hibernation in April, when the asparagus shoots were appearing, but fed mostly on self-sown asparagus and on seedlings and newly-set plants. Few eggs were deposited on cutting shoots, and injury to these, which in some fields amounted to 20 per cent., was generally due to cutworms, chiefly *Agrotis vetusta*, Wlk. Adults of the first generation emerged from the soil in June, towards the end of the cutting season, and fed and oviposited on the main crop, which was producing succulent foliage. Insecticides cannot be used against this generation while the asparagus is in flower, owing to the risk of poisoning honey-bees, but little loss of efficiency results from spraying before or after the flowering period. In the insectary, the egg, larval and pupal stages lasted 4–7, 5–12 and 14–18 days, respectively. A generation is completed in about a month in summer, and four were produced in 1940. Pupae of *A. simplex* overwinter in mines in the stubs of stalks of asparagus left in the field and in the stalks of self-sown plants. The larvae mine the stems immediately below the epidermis for a distance extending 2 or 3 ins. above and below ground level, and later pupate in the mines. In the insectary, the adults lived for only 4–5 days ; the combined egg and larval stages lasted 15–18 days, and the pupal stage about 22 days. A generation was completed in about 6 weeks in summer, and three were observed in 1940. The stalks did not appear to be killed by the infestation even when severely mined.

It is stated in the report of the Cranberry-Blueberry Laboratory (pp. 104–106) that dormant sprays of 6 per cent. stove oil gave satisfactory control of *Aspidiotus perniciosus*, Comst., and Putnam's scale [*A. ancylus*, Putn.] on cranberry without injuring the crop ; the addition of 1 per cent. stove oil to liquid lime-sulphur at dilutions of 1 : 10 and 1 : 15 was not injurious but did not increase the effectiveness of the lime-sulphur. Dormant sprays of lime-sulphur or oil tend to delay the beginning of growth in the spring. In an attempt to discover an ovicide for use against eggs of the fireworm [*Rhopobota naevana*, Hb.] 2 per cent. kerosene, which did not injure the cranberry vines except when they were in full bloom, was of value only against eggs that were about to hatch, but improved control resulted from its inclusion in sprays containing pyrethrum and rotenone [*cf.* preceding abstract]. Fish oil in several combinations caused severe injury, even when used at as low a concentration as 1 : 400. In general, injury by the fruitworm [*Mineola vaccinii*, Riley] was insignificant. Adults appeared at the beginning of May, which is earlier than usual, and most of them were killed by sprays applied against *R. naevana*. Damage by *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., and *O.* (*B.*) *ovatus*, L., occurred in dry cranberry bogs in one district. Treatment with sodium cyanide, which was used at the rate of 6 oz. in 100 U.S. gals. water and applied in sufficient quantities to wet the soil to a depth of 3–4 ins. [*cf.* preceding abstract], did not injure the vines and was more effective than the use of proprietary baits.

HARMAN (S. W.). **The Cranberry Rootworm as an Apple Pest.**—*Bull. N. Y. agric. Exp. Sta.* no. 692, 11 pp., 4 figs., 1 ref. Geneva, N.Y., 1940.

The accounts here given of the injury caused to the fruit and leaves of apple by the adults of *Rhabdopterus picipes*, Ol., in uncultivated orchards in western New York, of the bionomics of this Eumolpid and of control measures tested against it in 1930 are similar to those in a paper already noticed [*R.A.E.*, A **19** 351]. Further tests with sprays were made in the following year. In 1930, the beetles caused considerable injury on trees that received a single application of lead arsenate (3 lb. per 100 U.S. gals.) on 11th June, which was apparently too early for adequate protection of the fruit, and in 1931, therefore, applications were deferred until 17th June, only a few days before the adults appeared. The sprays were timed by digging in the sod beneath the trees for pupae, which show dark eye-spots a few days before transforming into adults, and gave satisfactory reductions in injury; a spray containing 3 lb. lead arsenate per 100 U.S. gals. was practically as effective as one containing 3 lb. lead arsenate and 1 U.S. quart fish oil or 6 lb. lead arsenate, though increasing the amount of arsenical appeared to prolong the period of protection afforded. The addition of fish oil resulted in spray injury on the foliage. A second application nine days after the first slightly improved the control obtained. Though cultivating one acre of the orchard for two years had little effect on the degree of infestation, it is possible that cultivation of the entire orchard for several years to destroy all root growth other than that of the apple trees might be effective. In districts in which cover sprays are applied against the codling moth [*Cydia pomonella*, L.], the first, which is applied by the third week in June, probably also helps to check this Eumolpid.

Entomology and Limnology.—*Rep. Cornell agric. Exp. Sta.* **51** (1938) pp. 111–120. Ithaca, N.Y., 1939. [Recd. 1941.]

Field studies in New York State by C. E. Palm, C. G. Lincoln and W. D. Wylie showed that the larvae, pupae and adults of *Otiorrhynchus* (*Brachyrrhinus*) *ligustici*, L., occur at much greater depths in light than in heavy soil. Pupation and adult emergence in spring are earlier in light soils, and poison baits [*cf. R.A.E.*, A **29** 252, 357] should therefore be applied earlier in such areas. Larval mortality was high in dense populations and low in light populations. In the laboratory, *O. ligustici* completed development on several food-plants, but lucerne was preferred.

Palm, T. W. Kerr, jr. and C. P. Zorsch carried out surveys on white grubs in two areas in which serious damage to crops had occurred. Near Brant, where injury to strawberry and raspberry has been severe, over 95 per cent. of the adults collected were *Lachnosterna* (*Phyllophaga*) *rugosa*, Melsh., while *L.* (*P.*) *anxia*, Lec., and *L.* (*P.*) *fusca*, Froel., occurred in small numbers. In the upper Champlain Valley, the last two were the major species. It appears that the larvae are a problem only on well-drained soils and not on heavy clay.

G. F. MacLeod and W. A. Rawlins state that the eastern field wireworm, *Pheletes* (*Limonius*) *ectypus*, Say, which is a serious pest of potato in western and central New York, is chiefly confined to sandy soils and infests fields in continuous cultivated rotation. Injury was reduced by treating potato tubers with sulphur and a mixture of talc and lead arsenate, by late planting and by planting whole instead of cut tubers.

Entomology and Limnology.—*Rep. Cornell. agric. Exp. Sta.* **52** (1939) pp. 130–139. Ithaca, N.Y., 1940.

H. H. Schwardt and T. W. Kerr, jr. state that shallow ploughing followed by multiple disking has given good control of second- and third-year white grubs [*Lachnosterna* spp.], but that many of the infested fields in New York State are too stony for disking.

Observations by G. H. Griswold have shown that carpet beetles, of which the black carpet beetle [*Attagenus piceus*, Ol.] appears to be the commonest in New York, fed on certain types of the deadening felt that is placed under hardwood floors. She also reports the results of tests with ovicides against the overwintering eggs of the borer [*Papaipema purpurifascia*, Grote & Rob.] that attacks the roots of columbine [*Aquilegia*]. This Noctuid scatters its eggs on the soil. A tar-distillate emulsion (coal-tar creosote oil emulsified with sulphite lye) killed all the eggs sprayed with it when used at concentrations of 3 per cent. or more, and all but one of them when used at 2 per cent. Emulsions containing 2–6 per cent. petroleum oil or 1–4 per cent. D-N oil (96 parts by weight lubricating oil and 4 parts dinitro-ortho-cyclohexylphenol) failed to kill all the eggs. Garden tests showed that the tar distillate can be applied in late autumn without causing lasting injury. It might also prove effective against the overwintering eggs of the iris borer [*Macronoctua onusta*, Grote], which are attached to dead leaves or other débris.

Studies by G. F. MacLeod, W. A. Rawlins and K. E. Nash have shown that scab gnats [*Sciara* sp. and *Pnyxia scabiei*, Hopk.] and millepedes [*Julus* sp.] have a close relationship to potato scab [*Actinomyces scabies*]. In potato-rotation experiments, injury by both gnats and millepedes was most severe when potatoes were grown continuously and was greater where lime and manure were used together than where either was used alone. In the course of the rotation experiments, it was observed that there was significantly more injury by wheat wireworms [*Agriotes mancus*, Say] when potatoes followed hay, maize or beans, than when they were grown continuously. Injury to the tubers was most severe when potatoes followed a two-years' sod [*cf. R.A.E.*, A **22** 392]. MacLeod and Rawlins observed that newly hatched larvae of the eastern field wireworm, *Pheletes* (*Limonius*) *ectypus*, Say, cannot survive without plant roots for food. Cultivation and early ploughing have no effect on this species, because the adults burrow into the soil to lay their eggs.

D. L. Collins investigated the value of sprays against the adults of *Scolytus multistriatus*, Marsh., which is still considered to be the chief vector in the United States of *Ophiostoma* (*Graphium*) *ulmi*, the fungus that causes Dutch elm disease. The fewest cases of transmission (based on the culturing of feeding wounds) occurred when the spray contained 8 lb. lead arsenate and 2½ U.S. gals. lime-sulphur per 100 U.S. gals. water. Cryolite was less effective. In experiments, the fungus was readily transmitted by *Scolytus sulcatus*, Lec. [*cf.* **29** 119], while transmission and at least terminal infection was effected by spraying a suspension of the spores on to wounds made by *Eutetrapha* (*Saperda*) *tridentata*, Ol., in the midribs of leaves and in tender terminal growth. Trees in exposed, sunny situations attracted the largest numbers of *S. multistriatus*, while *S. sulcatus* was found in felled elm trees in several localities. The fungus was cultured from two examples of *Magdalis* sp. taken in widely separated places, and two tunnels of *Hylastes* (*Hylurgopinus*) were found to contain the coremia.

T. R. Hansberry and L. B. Norton report the results of a study on the mode of action of nicotine compounds on insects [*cf.* **29** 206]. The toxicity of soluble compounds applied as a contact poison was approximately proportional to their nicotine content. Insoluble salts were substantially non-toxic as contact poisons. In investigations on the toxicity of fixed and free nicotines to newly hatched larvae of the codling moth [*Cydia pomonella*, L.], nicotine silicotungstate and nicotine reineckate, two of the most insoluble forms known, proved as good as or better than nicotine bentonite.

RAWLINS (W. A.). **Biology and Control of the Wheat Wireworm,** *Agriotes mancus* **Say.**—*Bull. Cornell agric. Exp. Sta.* no. 738, 30 pp., 1 col. pl., 12 figs., 8 refs. Ithaca, N.Y., 1940.

Much of the information in this account of the bionomics and control of *Agriotes mancus*, Say, which attacks potatoes in western New York is similar to that noticed from a briefer paper [*R.A.E.*, A **22** 391]. The damage caused to the seed pieces, stems and tubers and the characters distinguishing the larvae of the three Elaterids most injurious to potatoes, *A. mancus*, *Pheletes* (*Limonius*) *ectypus*, Say, and *Melanotus* sp., are described and illustrated. Wireworms feed on the underground parts of living plants, and possibly also on humus and small soil-inhabiting animals, but newly hatched larvae of *A. mancus* failed to survive in soils containing abundant humus unless the roots of growing plants were available ; second- and third-year larvae were more resistant to starvation, and when they were kept in soil without growing plants, a small proportion survived for two years, though there was no larval growth. Annual surveys of potato fields showed that the populations of larvae were usually considerably reduced by natural mortality in the course of a year, though the reductions were not large enough to render control measures unnecessary.

The adults of *A. mancus* are less active than those of other Elaterids and fly less ; they are most active during warm days, at temperatures above 85°F., but the longest recorded distance travelled when large numbers were released at a point surrounded by numerous baits was about 11 yards. In the field, the beetles have been observed on foliage and flowers, but there was no evidence of feeding. In cages, they chewed the cut edges of grass clippings and apparently ingested some of the pulpy material, and also fed voraciously on sugar syrup, molasses and honey. They were readily collected in cultivated fields from handfuls of grass or weeds placed on moist soil and covered with a shingle ; they congregated in the foliage during the night and were collected the following day. The numbers of eggs laid by each of ten females in the laboratory ranged from 48 to 176, with an average of about 105. It was difficult to obtain data on egg-production, because most of the beetles died without completing oviposition ; those collected in early spring did not oviposit unless fed on sugar solutions, which suggests that food is necessary during the oviposition period.

COLLINS (D. L.), PARKER (K. G.) & DIETRICH (H.). **Uninfected Elm Wood as a Source of the Bark Beetle** (*Scolytus multistriatus* **Marsham**) **carrying the Dutch Elm Disease Pathogen.**—*Bull. Cornell agric. Exp. Sta.* no. 740, 14 pp., 8 refs. Ithaca, N.Y., 1940.

The following is based on the authors' summary and conclusions. As many as 15 per cent. of the adults of *Scolytus multistriatus*, Marsh., collected in the field in south-eastern New York State were found, by culturing, to be infected with *Ophiostoma* (*Ceratostomella*) *ulmi*, the fungus that causes Dutch elm disease. When beetles were artificially infected with spores and allowed to enter healthy elm wood, as many as 74 per cent. of their progeny emerged carrying spores. Up to 62 per cent. of the beetles that emerged from healthy cut logs exposed to normal attack in the field were infected, and up to 25 per cent. of those from pieces of uninfected dead wood found in the field. Infected beetles also developed in uninfected elm wood in farmers' wood-piles. Up to 16 per cent. of the beetles that emerged from piled short lengths of diseased wood were infected when it was stored out of doors, and up to 9 per cent. when it was stored in sheds. The corresponding percentages for healthy wood stored in similar ways, but subjected to entry by spore-bearing beetles, were 14 and 19. In 1939, 217 of the 304 trees known to be infected in the peripheral regions of the diseased area were inspected ; 127 were recorded as having become infected in 1939, and uninfected wood from which *S. multistriatus* had emerged in the spring or early summer of 1939 was discovered in the vicinity of 65 of them. There appeared to be a definite correlation between beetle emergence and feeding and the probable time of infection, suggesting that the fungus was carried to the trees by beetles that had emerged from uninfected wood. Since it was shown that infected beetles can develop in uninfected wood, it appears that dead or dying elmwood of whatever origin, if suitable for the breeding of *S. multistriatus*, is a potential source from which the fungus can be disseminated by emerging beetles. It may serve both for continuing local dissemination of the fungus and for transferring it from a diseased area to regions hitherto free from it.

LINN (M. B.). **The Yellows Disease of Lettuce and Endive.**—*Bull. Cornell agric. Exp. Sta.* no. 742, 33 pp., 16 figs., 31 refs. Ithaca, N.Y., 1940.

The following is based largely on the author's summary. An account is given of investigations showing that a yellows disease of two varieties of endive (*Cichorium endivia*) observed on Staten Island, New York, in 1933 is caused by the virus of eastern aster yellows, which is transmitted by *Macrosteles divisus*, Uhl. This disease also occurs in lettuce and is a limiting factor in the production of late-summer and autumn crops of both plants on Staten Island. It has been reported in lettuce from the principal lettuce-producing States and from Bermuda and Ontario ; in endive, it occurs principally in lower New York State and New Jersey. Average losses are estimated at less than 6 per cent. of the normal lettuce and endive crops. The characteristic symptoms on both plants are yellowing, stunting and twisting of the leaves ; other abnormalities are discussed. Experiments in which infective examples of *M. divisus* were caged with 25 plants each of 23 varieties and strains of lettuce showed that all are equally susceptible to the virus. Any varietal differences that may be observed in the field are considered to be due to preferential feeding on the part of the vector.

On Staten Island, the virus has been found to overwinter chiefly on the common plantain (*Plantago major*), from which it is carried by the leafhopper to lettuce and endive. The exact manner in which *M. divisus* passes the winter on Staten Island has not been determined. Circumstantial evidence suggests that overwintering seldom, if ever, occurs in the egg stage, and that it may occur in the adult stage at a considerable distance from cultivated areas. Studies on the dispersion of *M. divisus* into and from weeds adjacent to endive beds showed that it is driven into the weeds during the harvesting of the crops and may later move back into endive or other crop beds. Tests with stained leafhoppers showed that wind may play a large part in determining the direction of their movement, and that they do not move in perceptible numbers much further than 200 ft. in four weeks. The eradication of weeds within 100 ft. of prospective lettuce and endive beds resulted in appreciable control of the disease, but removing infected plants was of little value in small lettuce plantings. Dusting with a mixture of pyrethrum and sulphur containing at least 0·15 per cent. pyrethrins or with derris and sulphur (1 per cent. rotenone) at weekly intervals from transplanting to harvest gave significant decreases of diseased lettuce plants [*cf. R.A.E.*, A **27** 537]. An increase of only 5 per cent. on marketable heads will normally cover the cost of dusting. The protection of young lettuce plants from the Jassids by growing them in cloth-covered cold frames or screened greenhouses before transplanting them into the field resulted in a considerable reduction in the number of diseased plants at harvest.

HRENOFF (A. K.) & LEAKE (C. D.). **Toxicity Studies on 2-4-dinitro-6-cyclohexyl-phenol, a new Insecticide.**—*Univ. Calif. Publ. Pharmacol.* **1** no. 12 pp. 151–159, 18 refs. 1939. (Abstr. in *Exp. Sta. Rec.* **83** no. 4 p. 520. Washington, D.C., 1940.) [Recd. 1941.]

Kagy & Richardson have shown that a 1 per cent. petroleum oil solution of 2-4-dinitro-6-cyclohexylphenol is strong enough to kill the San José scale [*Aspidiotus perniciosus*, Comst.] and eggs of various orchard pests without damage to trees or fruit [*cf. R.A.E.*, A **24** 411], and feeding experiments reported in this paper clearly indicate that there is no danger to consumers from fruits from trees dusted with preparations containing 1 per cent. of this chemical.

LYLE (C.). **Derris Dust for Control of Cucumber Insects.**—*Miss. Farm Res.* **3** no. 4 p. 8. 1940. (Abstr. in *Exp. Sta. Rec.* **83** no. 4 p. 520. Washington, D.C., 1940.)

In experiments in Mississippi, derris dust containing 0·5–0·75 per cent. rotenone has been the most effective insecticide tested against the striped cucumber beetle [*Diabrotica melanocephala*, F.], which attacks the plants as they come through the ground and serves as the overwintering host for bacterial wilt of cucurbits ; the addition of copper oxychloride gave some control of the disease. A mixture of basic copper arsenate and talc (1 : 19) was as effective as one of calcium arsenate and talc, gypsum or hydrated lime (1 : 9), which is recommended if derris is not available ; applications should be made once or twice a week when the adults are most numerous.

Some tests in 1939 indicated that derris dust reduced infestations of pickleworm [*Diaphania nitidalis*, Stoll] on cucumber, but it was not determined whether the control obtained justified the expense.

EVENDEN (J. C.) & GIBSON (A. L.). **A destructive Infestation in Lodgepole Pine Stands by the Mountain Pine Beetle.**—*J. For.* **38** no. 3 pp. 271–275, 2 figs. 1940. (Abstr. in *Exp. Sta. Rec.* **83** no. 4 p. 526. Washington, D.C., 1940.)

A brief history is given of the destruction of standing timber resulting from an outbreak of the mountain pine beetle [*Dendroctonus monticolae*, Hopk.] in stands of lodgepole pine [*Pinus contorta*] in the Beaverhead National Forest, Montana. It is shown that this outbreak has covered 1,341,860 acres, during the past ten years and has caused the death of about 57,756,000 trees over 3 ins. in diameter. It is estimated that the total percentage loss of merchantable trees 9 ins. and more in diameter at breast height is 77·3.

MITCHENER (A. V.). **Field Crop Insects and their Control.**—*Circ. Dep. Agric. Manitoba* no. 140 folder [16 pp.]. Winnipeg, 1940.

This circular comprises a table showing the principal insect pests of field crops in Manitoba, the plants attacked by each, the nature of the damage and the season in which it may be observed, the habits and appearance of the injurious stages, and methods of control, together with a key for the identification of the injurious stages, directions for making up baits for grasshoppers and cutworms, and notes on farm practices that assist in insect control.

PICKLES (A.). **Insecticides for Use in *Citrus* Orchards.**—*Proc. agric. Soc. Trin. Tob.* **40** pt. 4 pp. 323–329. Port-of-Spain, 1940.

Directions are given for the preparation and use of lime-sulphur, oil emulsions and mixtures of oil emulsions and Bordeaux mixture for the control of the common pests of *Citrus* in Trinidad. Coccids can usually be controlled by three applications of oil emulsion at intervals of a month, but if scab disease is also present, mixtures of Bordeaux mixture and oil emulsion should be used before and at blossom time, followed by oil emulsion a month later if necessary. When Bordeaux mixture is used for the control of scab disease, there is generally an increase in the abundance of Coccids unless oil emulsion is combined with it. Rust mite [*Phyllocoptruta oleivorus*, Ashm.] is best controlled by means of dry sulphur dust, but as dusting equipment is rarely available in the Colony, weak sprays of lime-sulphur should be used when it occurs either alone or with Coccids. When scab disease is also present, pre-blossom or blossom sprays of Bordeaux mixture and oil emulsion should be followed by blossom or post-blossom sprays of lime-sulphur, unless the disease is relatively mild, when lime-sulphur can be used throughout.

OTANES (F. Q.) & BUTAC (F. L.). **Cotton Pests in the Philippines.**—*Philipp. J. Agric.* **10** no. 4 pp. 341–371, 13 pls., 25 refs. Manila, 1939. [Recd. 1941.]

This is a revision of a paper [*R.A.E.*, A **23** 708–710; *cf.* also **24** 327] on the bionomics and control of insects that attack cotton in the Philippines. The salient features of the life-history of most of them are similar to those already given [**23** 709], and the information on the bionomics and control of the bollworms, *Platyedra* (*Pectinophora*) *gossypiella*, Saund., and *Earias* spp., has been noticed from another source [**27** 183].

Spraying with soap solution is recommended against sucking insects and mites (*Tetranychus* sp.). When applied against *Aphis gossypii*, Glov., *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., and *Empoasca flavescens*, F., the spray should be directed to the lower surfaces of the leaves to ensure thorough wetting of the insects. Control measures against

Pempherulus (*Pempheres*) *affinis*, Faust, include hand-picking of adults in the early morning, prompt removal and burning of infested stems and, if the attack is severe, the burning of the whole plant. Hand-picking of larvae and spraying with soap solution or calcium arsenate are suggested for the control of *Sylepta derogata*, F. The species of *Homona* and *Bemisia* previously recorded [**23** 709] have been identified as *H. phanaea*, Meyr., and *B. inconspicua*, Quaint., and one of the species of thrips as *Bussothrips claratibia*, Moult. [*cf.* **24** 327]. Insects observed in small numbers on cotton and considered of minor importance are *Dysdercus poecilus*, H.-S., *Tectocoris diophthalmus*, Thnb. (*lineola*, F.), *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.), *Nezara viridula*, L., *Drosicha townsendi*, Ckll., *Ricania speculum*, Wlk., *Dictyophara* sp., *Phaneroptera furcifera*, Stål, and *Prodenia litura*, F.

GONZALES (S. S.). **A new Phytophagous Lady Beetle in the Philippines.**—*Philipp. J. Agric.* **10** no. 4 pp. 415–417, 3 pls. Manila, 1939. [Recd. 1941.]

The larvae and adults of the Chrysomelid, *Plagiodera metallica*, Er.,* all stages of which are briefly described, have for some time seriously defoliated *Flacourtia indica* in the Los Baños Economic Garden. This species has so far not been recorded as a pest in the Philippines and no other food-plant is known. Oviposition usually occurs at night, eggs being deposited singly or in small groups on both surfaces of the young leaves. The larvae hatched in about 3 days, and at first they crowd together on the under surface of the leaf, nibbling the edges of young leaves and producing irregular cuts along the margin. Later they disperse, gradually become more voracious and often entirely defoliate the trees. The larval stage lasted about 6 days and the pupal stage 3–4 days, pupation occurring on the leaves or twigs of the food-plant. The adults survived for 10–40 days in the laboratory, and beetles confined without food were still alive after a week.

Promising results in control have been obtained by collection of all stages of the beetle and spraying with soap solution or lead or calcium arsenate.

ZIMMERMAN (E. C.). **A new Philippine Cucurbit-boring Barid (Coleoptera, Curculionidae).**—*Philipp. J. Sci.* **73** no. 3 pp. 313–319, 1 fig., 1 ref. Manila, 1940.

A description is given of the adults of both sexes of *Manilabaris cucurbitae*, gen. et sp. n., found in the stem of a cucurbit in Manila in 1938, together with characters distinguishing *Manilabaris* from closely related genera. Several undescribed species of the same genus are known by the author to occur in Java.

G. Merino states that *M. cucurbitae* has been found to be a serious pest of *Luffa* sp., bitter melon (*Momordica charantia*) and white squash (*Lagenaria siceraria*) in Manila. The eggs, which are briefly described, are deposited in the stem of the food-plant, and the larvae bore in the soft tissue in all directions, hollowing out the stem and eventually killing the vine.

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* This species is recorded as a Coccinellid by the author, owing to the misunderstanding of a letter on its identity from the Imperial Institute of Entomology. It was described by Erichson as *Coccinella metallica*, but has been found by Chen to be a Chrysomelid of the genus *Plagiodera*.—Ed.

Holdaway (F. G.) & others. **Entomology.**—*Rep. Hawaii agric. Exp. Sta. 1940* pp. 38–45, 2 figs. Honolulu, 1941.

The results are given of surveys of the pests of important crops in Hawaii, particularly on the island of Oahu. The major pests of garden beans are *Adoretus sinicus*, Burm., the adults of which skeletonise the leaves, *Maruca testulalis*, Geyer [*cf.* *R.A.E.*, A **29** 35], which attacks blossoms, pods and stems, *Empoasca solana*, DeLong, which causes hopperburn, the Capsid, *Pycnoderes quadrimaculatus*, Guér., and *Aphis medicaginis*, Koch, which is only occasionally abundant. *Tetranychus* sp. and a Tarsonemid mite were observed on the foliage. A test with 15 varieties of pole beans showed that there was a considerable range in susceptibility to *M. testulalis*. In further work on the use of tetramethyl thiuram disulphide against *Adoretus sinicus* [*cf.* **26** 752], a spray containing 2½ lb. per 100 U.S. gals. applied every 4–5 days during the period of maximum plant growth and at weekly intervals at other times reduced the damage by this Rutelid only slightly, but was of considerable value against *M. testulalis*. It increased the total yield and the marketable crop by 22·5 and 58·5 per cent., respectively.

The most serious pests of papaya are mites, including *Tarsonemus* (*Hemitarsonemus*) *latus*, Banks, *Tetranychus* sp. and at least two other Tetranychids. Sucking insects are also important, and it is possible that they may include vectors of papaya mosaic [*cf.* **29** 35]. *Gnorimoschema operculella*, Zell., is an important pest of potato during the warmer months, while *Conocephalus saltator*, Sauss., *Oxya chinensis*, Thnb., *Laphygma exigua*, Hb., and *Plusia* (*Autographa*) *chalcites*, Esp., cause severe injury to the foliage during the winter. *Macrosiphum solanifolii*, Ashm. (*gei*, auct.), *Aphis gossypii*, Glov., and *Myzus persicae*, Sulz., also cause serious damage to potatoes, and although they are attacked by predators and parasites, the inclusion of an insecticide such as nicotine sulphate in the routine spray is essential for their control.

Investigations on the parasites of *Pieris rapae*, L., on cabbage [*cf.* **29** 34] were continued. A wilt disease caused a high mortality of the larvae, particularly at elevations of less than 1,000 ft. In many places in which the disease occurred, none of the larvae was parasitised by *Apanteles glomeratus*, L., while the maximum parasitism by this Braconid (95·7 per cent.) was in a place at an elevation of 2,100 feet where wilt disease was absent. Larvae of *A. glomeratus* die if their hosts are affected by the disease, but well developed larvae of *Achaetoneura* (*Frontina*) *archippivora*, Will., do not, and this indicates the desirability of securing an efficient Tachinid parasite for the control of *P. rapae*.

Severe damage to tomato, particularly if it is grown near maize, is caused by *Heliothis armigera*, Hb., which breeds throughout the year at elevations from sea level to 2,000 feet. The only parasites reared from it (*Hyposoter exiguae*, Vier., *A. archippivora*, *Euplectrus platyhypenae*, How., and *Pristomerus hawaiiensis*, Ashm.) account for a very low percentage mortality as they are primarily parasites of other Lepidoptera. Continued observations on *Engytatus geniculatus*, Reut. (*Cyrtopeltis varians*, Dist.) [*cf.* **29** 34] confirm the suggestion that the prevalence of the Capsid is correlated with a hot, dry climate. Watermelon, long squash, dishcloth gourd [*Luffa cylindrica*] and *Ipomoea pentaphylla* have been added to the list of food-plants. As large populations develop only on tomato, a cessation of tomato production is advised in hot, dry regions during the summer months. On tomato plants infested with Aphids, the Capsid attacked the Aphids and not the tomato stems [*cf.* **26** 214].

Variations in the abundance of *Aphis gossypii* on *Hibiscus* have been observed during the past two years. There are two main peaks of abundance, one in the autumn and the other in spring, and seasonal changes in temperature and relative humidity are small and show no correlation with the fluctuations in the population. Apparently sunlight is the most important factor ; high and low amounts of sunlight both precede decreases in Aphid abundance. Sixteen species of predators were observed, the commonest being *Coelophora inaequalis*, F. The Braconid, *Lysiphlebus testaceipes*, Cress., was active during only a few months each year, and evidence suggests that it is neither an abundant nor an efficient parasite.

Murgantia histrionica, Hahn [*cf.* **29** 35] is still restricted to the region of Oahu extending from Ewa to Lualualei but has been found to attack daikon [a variety of radish] as well as cabbage. The egg parasite, *Ooencyrtus johnsoni*, How., has been introduced from California against it and has been liberated in the infested area. *Nysius nemorivagus*, White, has recently been breeding abundantly on Chinese cabbage [*Brassica chinensis*] and cucurbits in two localities in Hawaii ; the adults were also numerous round roots of *Solanum nodiflorum* in fields of Chinese cabbage. The only previous record of this Lygaeid from a cultivated plant was in 1933, when it attacked the terminal shoots of potato plants at another place in Hawaii. *Laphygma exigua* caused considerable damage to many different vegetables over a wide range of climatic conditions from very dry and hot to moderately moist and cool.

Insects recorded for the first time in the Hawaiian Islands are *Plusia* (*Autographa*) *brassicae*, Ril., on cabbage and cauliflower, *Macrosiphum* (*Amphorophora*) *sonchi*, L., on tomato, *Micromyzus formosanus*, Tak., on chives and Japanese onion, *Myzus circumflexus*, Buckt., on papaya and rose, and *Rhopalosiphum pseudobrassicae*, Davis, on broccoli, Chinese cabbage and tomato. New food-plant records for Hawaii comprise *Amorbia emigratella*, Busck, on broccoli, papaya, ground-nuts, potato and tomato ; *Aphis maidis*, Fitch, and *A. middletoni*, Thos., on papaya and tomato ; *A. medicaginis* on asparagus tips ; *Empoasca solana* on lettuce and ground-nuts ; and *Heliothis armigera* on several kinds of vegetables.

The Application of Emulsions of Petroleum and Tar Oils for the Control of Pests of agricultural Crops. [*In Russian.*]—Demy 8vo, 95 pp., 8 figs., 14 graphs, refs. Moscow, Vsesoyuzn. Akad. s.-kh. Nauk Lenina, 1939. Price 4 *rub.* [Recd. 1941.]

This publication comprises a series of ten papers, of which the first, by A. D. Kraĭtor [Kraĭter] (pp. 5–22), is a review of the history of the use of emulsions of petroleum and coal-tar oils as insecticides in the Russian Union and other parts of the world, and the second, by T. Ya. Nosovskaya (pp. 23–28), outlines the development of the manufacture of various concentrates of petroleum oils in Azerbaijan and includes brief notes on the character of some of the preparations produced. The remaining papers are noticed below.

Eĭdel'man (Z. M.). **The Action of Mineral Oil Emulsions on Plants** pp. 29–40. The work carried out in the Russian Union since 1934 on the effect of emulsions of mineral oils on the physiology of plants is reviewed [*cf.* *R.A.E.*, A **26** 355, 482, etc.]. Observations on sprayed seedlings of mandarin orange in a greenhouse showed that refined oils of low viscosity (1·5° Engler at 50°C.) were the least harmful, as they did not interfere with the normal physiological processes of the leaves. The intensity of photosynthesis, transpiration and respiration of the leaves was, however, sharply reduced if the oil contained a considerable quantity of sulphonatable compounds. The degree of penetration of the oil into the plant tissues depended largely on its surface tension. The duration of the disorganisation of the physiological processes in the leaves increased with the viscosity of the oil (up to 6° in the experiments), irrespective of the degree of refinement. Higher concentrations of oil in an emulsion, irrespective of viscosity, increased the harmful effect on the plants. It is concluded from these findings, which were confirmed in field experiments in Sukhum, that oils to be used for spraying *Citrus* in summer should be of low viscosity (1·5–1·8°) and contain not more than 2–3 per cent. sulphonatable compounds [*cf.* **26** 355].

Investigations on the connection between the moisture content of the leaves and their reaction to oils showed that water in the cell walls and water vapour in the intercellular spaces interfere with the penetration of the particles of oil into the latter and hinder their contact with the tissues. In experiments, sprayed apple trees growing in moist soil shed a smaller proportion of their foliage than those in dry soil. At least three days must elapse after watering before the tissues of the leaves become saturated with water and better able to resist the injury caused by the oils.

Observations in the north-western Caucasus showed that dormant sprays of oil emulsion applied to fruit trees in autumn as soon as all their leaves had fallen did not injure pome fruits, but killed up to 10 per cent. of the one-year-old branches of stone fruits. Winter sprays should therefore be applied to pome fruits in the Province of Krasnodar between the end of leaf fall and the bursting of the buds, and to stone fruits in the period commencing a month after the end of leaf-fall and ending when the buds begin to burst.

Popova (A. I.). **The Use of Petroleum Oil Emulsions for the Control of the Californian Scale**—*Aspidiotus perniciosus*, **Comst.,** pp. 41–53. The distribution of *Aspidiotus perniciosus*, Comst., in the Russian Union and the kind of damage it causes to fruit trees are discussed [*cf.* **27** 315, etc.], and a review is given of the work carried out in 1935–38 in the districts of Sochi on the Black Sea Coast and of Maĭkop and Slavyansk in the Krasnodar region on its control by mineral-oil emulsions. The effectiveness of winter and summer spraying is shown in tables and graphs, and it is concluded that mineral oils will reduce an infestation only if the trees are kept in good condition, the crowns are pruned and thinned, the trunks and branches are freed from loose bark, moss and lichen, which shelter the Coccid, and woody undergrowth between the rows and at the edges of orchards is destroyed. The best time to spray is in the autumn-winter period when the Coccids are in the first instar, and particularly in early spring (as soon as the sap begins to rise), when the first moult is in progress [*cf.* **26** 480]. In the winter of 1935–36 near Sochi, two applications of a 4 per cent. oil emulsion, combined with clean cultivation, resulted in 99·1–100 per cent. mortality of the Coccid on apples and plums, as compared with only 30·3 per cent. in the controls, and in a yield of 94·5 per cent. uninfested fruit. When applied to apple in summer, emulsions of a machine-oil distillate and of an alkalised spindle-oil distillate both gave poor results at a concentration of 1 per cent. [*cf.* **26** 481], and scorched the leaves at a concentration of 2 per cent. Investigations in a number of orchards showed that the low effectiveness of applications in winter or spring was due chiefly to lack of cultural measures and inadequate spraying. A decrease in the concentration of oil in the sprays to 3 per cent. was found possible only in clean cultivated orchards.

PETRUKHIN (K. V.). **Control of the Californian Scale on the Maïkop Experiment Station during the Years 1934-1936,** pp. 54–58. Experience has shown that dormant sprays are unsatisfactory for the control of *Aspidiotus perniciosus* on fruit trees in the north-western Caucasus, as the period during which the trees are dormant is short, and sharp fluctuations in temperature and the occurrence of frequent rain, strong wind and snow followed by frost interfere with spraying and decrease its effectiveness. Experiments with summer sprays were therefore carried out near Maïkop. Spraying infested pear and apple trees 2–6 years old during the last ten days in July and again during the first ten days in October with a 2 per cent. emulsion of a machine-oil distillate gave about 70 per cent. control and did not injure the leaves. In other orchards, apple trees 10 years old were slightly scorched and apples, pears and sloes 20 years old were severely injured, but in the latter case the rate of application was excessive. The practice of smearing nursery stock and the trunks of trees with oil emulsions should be discontinued, as it is harmful to the plants [*cf.* **27** 681].

IVANOVA (N. A.). **Experiments in the comparative Study of the Action of Petroleum, Coal-tar and Schist Oils on the Eggs of the Apple Sucker**—*Psylla mali*, pp. 59–64. In investigations in the Province of Voronezh in 1936 and 1937, sprays containing petroleum, coal-tar or schist oils against eggs of *Psylla mali*, Schm., were applied to apple trees in April, before the opening of the buds. The oils were emulsified with soft soap at the rate of 3 lb. soap to 2 gals. oil. Heavy coal-tar oils gave complete control [**26** 482]; and two highly refined petroleum oils were very effective, but slightly refined petroleum oils and schist oils gave poor results. The better of the two highly refined petroleum oils (green oil T), which practically freed the trees from infestation when used at a concentration of 2 per cent., was rich in aromatics and was easier to use than the coal-tar oils because it remained uniform on cooling, whereas the coal-tar oils gave off a considerable quantity of crystalline and amorphous substances, such as naphthalene and anthracene. Light coal-tar oils were almost completely non-toxic.

GEORGOBIANI (T. A.). **The Use of Petroleum Oil Emulsions for the control of Pests of subtropical cultivated Plants in the humid Subtropics,** pp. 65–70. In experiments against pests of *Citrus* in Transcaucasia, a 1 per cent. emulsion of machine oil killed up to 97 per cent. of *Pulvinaria aurantii*, Ckll., and up to 86 per cent. of Coccids of the genera *Chrysomphalus*, *Aonidiella* and *Lepidosaphes* and mites. Mealybugs and *Ceroplastes* spp. were very resistant. Mandarin oranges and lemons were less affected by oil emulsions than oranges, grape-fruits and citrons. Oil for winter spraying of *Citrus* should be of the spindle-oil type, with a viscosity of 2·2–2·5°. Lighter oils having a viscosity of 1·8–1·9° should be used for spraying in spring. Experiments indicated that two applications a year are sufficient, one in winter, between December and February, and the other in March or April, before the beginning of the vegetation period. Summer spraying should be considered only a secondary measure, owing to the lack of preparations with a completely neutral emulsifier that would be harmless to the plants. Nevertheless, a survey of about 20 farms showed that wherever summer spraying was carried out correctly, mineral oils did not injure the plants ; a spray containing 1 per cent. petroleum oil emulsified with dolphin-oil soap killed 92 per cent. of *Aonidiella citrina*, Coq., and one containing 2 per cent. oil killed 96 per cent. of *Lepidosaphes* sp. and 100 per cent. of *Coccus* (*Lecanium*) *hesperidum*, L. Tests with a clay from the Crimea showed that it can be effectively used as a substitute for the more expensive soap emulsifiers.

Sazonov (P. V.). **Mineral Oils as Improvers of Dust Insecticides,** pp. 71–82. When insecticides are applied to plants in the form of dusts, there is considerable wastage owing to wind and insufficient adhesive power. In one instance in which cotton was dusted with sodium fluosilicate, 42 per cent. of the initial amount of the insecticide settled on the plants and the percentages adhering were only 24 after 1 hour and 15 after 24. For dusting to be as effective as spraying against *Loxostege sticticalis*, L., on sugar-beet, it was necessary to apply 4 and 10 times the amount of sodium fluosilicate and calcium arsenate, respectively. Attempts have therefore been made to improve the effectiveness of dusts by impregnating them with mineral oils, and work in this connection is reviewed [*cf.* **26** 426 ; **27** 308, etc.]. The addition to calcium arsenate dust of spindle oil [*cf.* **25** 157] increased the mutual adherence of the particles and caused the formation of spherical grains with a minimum surface area ; this increased the speed of precipitation, which varied (within certain limits) with the amount of oil used. In the case of sodium fluosilicate, which is crystalline in structure and consequently has a much greater surface area than have spherical particles, precipitation was retarded by the addition of increased amounts of oil. The addition of more than 15 per cent. oil to calcium arsenate caused the dust to become lumpy ; this did not increase the amount of the dust that settled, but made the deposit uneven. Tests on larvae of *Pieris rapae*, L., showed that the addition of spindle oil does not alter the toxicity of sodium fluosilicate, the minimum lethal dosage of which was 1·1 mg. per gm. live weight, whether used alone or with 2½ per cent. oil. The larvae, however, fed less on leaves dusted with the mixture. The dusts were impregnated with oil by spraying them in a drum, rotating the drum for 15–20 minutes and then passing the dust through a sieve two or three times.

Khoroshkevich (N. S.). **Machinery for the Control of agricultural Pests by Means of Mineral Oils,** pp. 83–89. Brief notes are given on the types of apparatus used in the United States for the application of atomised sprays of undiluted oil, together with a description of a machine constructed in the Russian Union that can be used to apply insecticides of various kinds, including ordinary and atomised sprays and dusts.

BOGDANOV (L. L.). **The Application of the Vapo-dust Method from Aeroplanes,** pp. 90–93. The author briefly discusses the use of oil emulsions for spraying plants, states that as good coverage can be obtained by applying atomised oils without water, and discusses the advantages of doing so from an aeroplane. Work to be carried out in this connection in the Russian Union is outlined.

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BEĬ-BIENKO (G. Ya.).] **Бей-Биенко (Г. Я.). On the Zonation of agricultural Crops, according to the Complexes of Pests (based on the Example of Biocenosis of Wheat Sowings)** [in northern Kazakstan]. [*In Russian.*]—*Mém. Inst. agron. Léningr.* (N.S.) 1939 no. 3 pp. 123–134, 1 diagr., 16 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1941.] [For briefer account see *R.A.E.*, A **27** 453.]

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DE SANTIS (L.). **Materiales para el estudio de los tisanópteros argentinos.** [A Catalogue of the Thysanoptera of Argentina.]—*Anu. rur. Prov. B. Aires* **9** pp. 143–153, 1 fig., 43 refs. La Plata, 1941.

CUTHBERTSON (A.). **A preliminary List of Tachinidae (Diptera) of Southern Rhodesia** [including host records].—*Occ. Pap. nat. Mus. S. Rhod.* **1** no. 10 pp. 5–19. Bulawayo, 1941.

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